**IN-DEPTH STUDIES FROM THE 1994 POPULATION AND HOUSING CENSUS IN ETHIOPIA**

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# INFANT AND CHILD MORTALITY IN URBAN ETHIOPIA: WITH SPECIAL REFERENCE TO SOCIO-DEMOGRAPHIC AND HOUSING CONDITIONS IN URBAN AREAS AND ADDIS ABABA

by

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# CHAPTER 1

# INTRODUCTION

Over the past decades the level of infant and child mortality has been declining in many of the developing countries including sub-Saharan Africa. This is largely attributable to health and nutrition interventions and improvements. Nevertheless the level of infant mortality in sub-Saharan Africa continues to be among the highest in the world. Regarding the situation of infant and child mortality in Ethiopia, the available evidences show, that there has been up and downs in the level of infant mortality in the country. According to the 1984 Census the level of infant mortality was 110 per 1,000 live births, while the 1990 Family and Fertility Survey revealed an infant mortality of 112; recent 1994 Census estimates report a level of 116.

Infant and child mortality rates are in their own right important indices to measure the condition of the youngest members of a society. The levels of infant and child mortality are also important indicators to measure health conditions of the society at large and to indicate the overall social and economic development of a society. Despite the efforts undertaken to improve the situation, overall levels of infant and child mortality in Ethiopia are still to be considered too high. As in other developing countries, malnutrition, infections and parasitic diseases are the major direct causes of high infant and child mortality. The main aim of the present study is to shed some light onto the underlying causes of the persistent high levels of infant and child mortality in Ethiopia. Infant mortality rates measure mortality in the first year of life, whereas child mortality rates measure mortality from 1 to under 5 years. Throughout this report it is not always possible to respect the definition of the later one and in some instances mortality rates for the population under five is reported.

Table 1.1 Infant and child mortality rates, Ethiopia and selected African countries 1995-2000

| Year | Infant mortality rate (per 1,000) | Mortality rate under age 5 (per 1,000) |
|---|---|---|
| Burundi | 119 | 179 |
| Eritrea | 91 | 146 |
| **Ethiopia** | **116** | **184** |
| Kenya | 66 | 104 |
| Madagascar | 83 | 116 |
| Malawi | 138 | 220 |
| Mozambique | 114 | 183 |
| Rwanda | 124 | 202 |
| Somalia | 122 | 204 |
| Uganda | 107 | 173 |
| United Rep. of Tanzania | 82 | 130 |
| Zambia | 82 | 147 |
| Zimbabwe | 69 | 117 |
| **Eastern Africa** | **101** | **161** |
| Egypt | 51 | 65 |
| Sudan | 71 | 112 |
| **Northern Africa** | **52** | **70** |
| **Africa** | **87** | **140** |

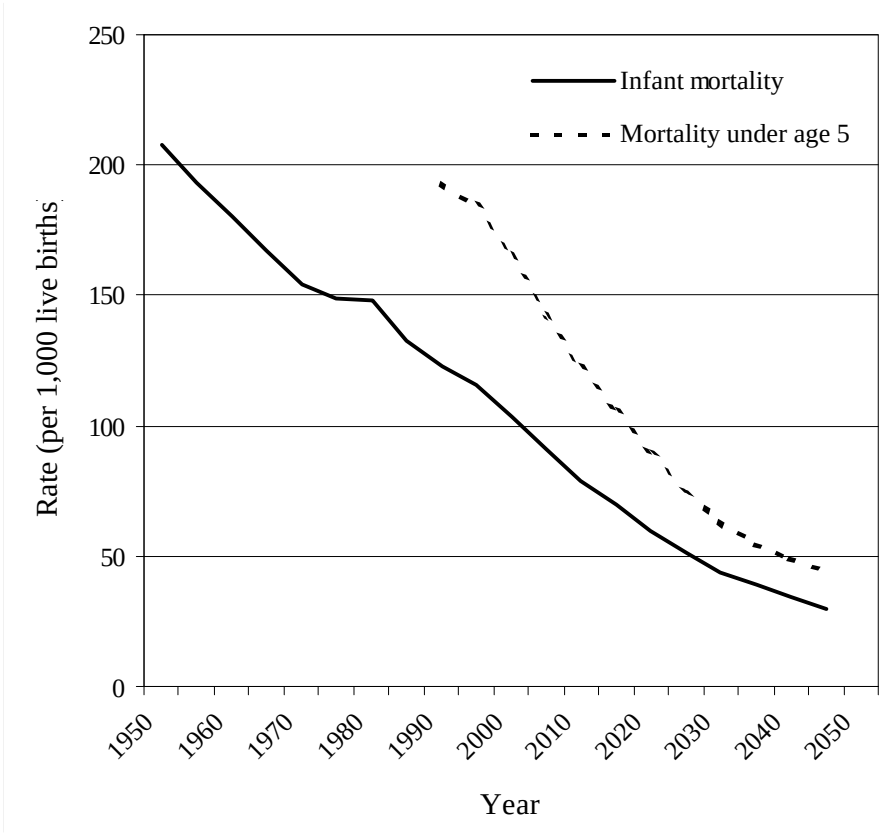
Source: United Nations (1999)

## 1.1 Historical trends in infant and child mortality in Ethiopia

The best source regarding the trends in infant and child mortality are the United Nations estimates and projections (United Nations, 1999). Figure 1 reports these estimates – based on few reliable information – of the past trends of infant mortality. For the 1950s the level of infant mortality is estimated above 200 per 1,000, or 1 out of 5 children did not reach its 1st birthday. This situation apparently improved until the 1970s. Regarding the progress of infant mortality the period 1975-85 was a lost decade when infant mortality stagnated at 150 per 1,000. Only in 1985-90 infant mortality started to decrease again and today Ethiopia has, with values around 110 deaths per 1,000 live births in the first year of life, one of the highest values of infant mortality in the world. In the 1990s mortality under age 5 is estimated at values above 180 per 1,000, implying that not even one out of 6 new-born is reaching its 5th birthday.

The further progress regarding infant and child mortality, as forecasted by the UN Population Division, will not come automatically, but can only be reached if specific and continuing efforts to improve public health and general social and economic development are undertaken.

Figure 1.1 Estimates and Projection of infant and child mortality, Ethiopia 1950-2050




Source: United Nations (1999), reported in the Annex

## 1.2 Infant and child mortality and famines in Ethiopia

Malnutrition caused by shortages in the Ethiopian food supply are endemic. 'For the period 1988-90, the UN's Food and Agriculture Organization (FAO) reports that Ethiopians received less than three-quarters (73%) of requirements for daily calorie supply, …' (Center for International Health Information, 1999, p. 5). In certain years shortages in the food supply, which are a recurrent problem in Ethiopia, develop into famines. The famines since the 1950s took place in 1958, 1972-74, 1978, 1984-85, 1987-88 and 1990-92. North-eastern Ethiopia, particularly Tigray and Welo, were often among the hardest hit regions. Kidane (1989) states that the land distribution system, which is based on a unique kinship system and leads to early marriage and high fertility, as well as wars and general insecurity, leads to famines when weather conditions are unfavourable. Needless to say that even if famines are confined to some regions, the deficiencies in infrastructure and organisation lead to disastrous effects. Kidane (1989) analysed the demographic responses to the 1984/85 famine, which touched predominantly the northern part of Ethiopia, and concluded that mortality rates among Ethiopian famine victims were very high and that higher mortality was generalised and not linked to specific socio-economic characteristics of the household. Kidane (1989) estimated the under 5 mortality rate for the refugee population with 316 per 1,000 for males and 276 for females. "… the consequences of the famine were general – it affected people

regardless of household size, wealth, or distance of residence from an urban center." (Kidane, 1989 p.519). Lindtjorn (1990) estimated that in 1985-86 the famine in southern Ethiopia caused a 40% increase in child mortality among children living in traditional and stable societies. The most disadvantaged group was represented by children living in relief shelters, where a threefold to fourfold increase in mortality was recorded among children. Seaman (1992) estimates the effect of the 1980-85 drought at 500,000 to 1,000,000 additional deaths. Seaman identifies as the main victims children and refugees as well as displaced persons, due to the important internal migration caused by draught. The devastating effects of famines are brought about directly through hunger and indirectly through the spread of communicable diseases. The situation in Tigray, where the population suffered wars and famines in recent decades, is analysed in Gebre-Egziabher and Hogan (2000).

## 1.3 Recent trends of infant and child mortality in Ethiopia

Statistical information of infant and child mortality in Ethiopia is generally based on information collected by the Central Statistical Authority. Infant mortality rates estimated during the 1980s based on the 1984 census (110 per 1,000 live births) and the 1981 and 1990 surveys (141 and 105 per 1,000 live births respectively) vary. These results could indicate a certain underestimation in the case of the 1984 census. Regarding the last decade the available sources are the 1994 Census and the Ethiopian Demographic and Health Survey of 2000.

Table 1.2 reports the results of these two statistical sources and presents in addition various estimates elaborated by international organisations. The estimates show a slight decline in infant mortality during the 1990s. Indirect estimates of infant mortality rates based on the 1994 data also show some decline between the early 1980s and 1992. The report of the Ethiopian DHS indicates a very positive trend in infant and child mortality over the last years, whereas the estimates for previous periods are higher than known from other sources.

Table 1.2 Estimates of infant and child mortality, Ethiopia 1990-1999

| **Source** | **1990** | **1991** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Infant mortality** (per 1,000) | | | | | | | | | |
| CSA – 1994 Census | 116 | | | | | | | | | |
| CSA – DHS 2000 | 133 | 130 | | | | | 97 | | | |
| UN 1998 | 123 | | | | | 116 | | | | |
| UNICEF | | | | | 117 | 114 | 113 | 111 | 110 | 118 |
| US Census Bureau IDB | 117 | 115 | 114 | 112 | 110 | 109 | 107 | 106 | 104 | 103 |
| | **Mortality under age 5** (per 1,000) | | | | | | | | | |
| CSA – 1994 Census | 171 | | | | | | | | | |
| CSA – DHS 2000 | 217 | 211 | | | | | 166 | | | |
| UN 1998 | 194 | | | | | 184 | | | | |
| UNICEF | | | | | 200 | 195 | 177 | 175 | 173 | 176 |

Note: Rates refer to single years or periods delimited by vertical traits. In the case of the CSA-DHS 2000 data the value reported for 1990 refers to the period 1986-1990

Source: United Nations (1999), US Census Bureau (www.census.gov), UNICEF (www.unicef.org), Central Statistical Authority (1998 and 2000)

## 1.4 The HIV/AIDS crisis

Ethiopia is very much exposed to the HIV/Aids crisis, which was mainly spread through blood transfusion and heterosexually. Responsibility is partly attributed to the military conflicts until 1991 – and probably also thereafter – which saw the mobilisation of up to 250,000 soldiers[1] (Eshete et al., 1993 cited in Gubhaju, 1997). Blood transfusions during the fighting, unprotected sexual intercourse, the demobilisation and prostitution caused the infection of a large part of the adult population. UNAIDS publishes estimates for all countries and the most recent ones for Ethiopia are reported in Table 1.3. According to these information the estimated prevalence rate for adults lies above 10 % in 1999. It can be assumed that the HIV/Aids crisis is predominantly still an urban phenomenon, but spreading rapidly in rural areas as well.

Children are suffering twofold from the HIV/Aids crisis, directly due to higher mortality and indirectly due to the loss of one or both parents. Orphaned children are certainly taken care of by the traditional extended family, but the sheer numbers indicate a rising problem, which will put additional stress on the social fabric of the Ethiopian society. The Ethiopian Demographic and Health Survey (Central Statistical Authority and Macro International, 2000) found a high awareness of HIV/AIDS with 96 % for men and 85 % for women. Still, the knowledge regarding avoiding HIV/AIDS seems to be limited. The 1994 census was taken at the outset of the HIV/AIDS crisis and it was impossible for the authors to identify demographic effects of the HIV/AIDS epidemic based on the census results. The national report 'Aids in Ethiopia' (Ministry of Health, 2000) gives estimates similar to UNAIDS (2000) and discusses in detail the consequences of the HIV/AIDS crises. Only the next census, planned for 2004, might allow to measure its devastating effects on the socio-demographic structure and the demographic trends.

Table 1.3 Estimates related to HIV/AIDS, Ethiopia 1999

| **Persons living with HIV/AIDS** | **UNAIDS** | |
|---|---|---|
| | **Number** | **Rate** |
| Men (15-49) | 1,300,000 | |
| Women (15-49) | 1,600,000 | |
| Adults (15-49) | 3,000,000 | (10.6 %) |
| Children | 150,000 | |
| Deaths in 1999 due to AIDS | 280,000 | |
| Orphans due to AIDS (alive under the age of 15) | 900,000 | |

Source: UNAIDS, 2000

[1] Other estimates mention even 500,000 soldiers.

## 1.5 Organisation of the report

Ethiopia is one of the least urbanised African countries. Therefore it might seem inappropriate that this report puts its focus on the urban population, but as it is well known, socio-economic characteristics and the amenities and infrastructures of households show small variations in the rural part of Ethiopia. The population is mainly illiterate, building materials are following local traditions, bathing and toilet facilities are normally non-existing and water comes mostly from river or unprotected wells. In contrast the population in urban areas is more heterogeneous and might give indications on possible future developments, therefore this report concentrates on the urban setting, even if the authors report rural information wherever available and useful or interesting.

The main objective of this study is to inform about the trends and patterns of infant and child mortality by using readily available information. The study group considered its main task as identifying regions and groups of women with children at risk of higher mortality during their first years of life. In identifying the children most vulnerable, the authors hope to be able to make a small contribution to the solution of a great problem and to the improvement of child survival programmes. In chapter 2 the determinants of infant and child mortality are discussed and the procedures traditionally used to estimate infant and child mortality are briefly described. Chapter 3 reports the main results of studies undertaken so far in Ethiopia regarding infant and child mortality. In chapter 4 the source and quality of available data is discussed. Chapter 5 reports the regional differences of infant and child mortality in Ethiopia and is based on the estimates of infant and child mortality at the zone level as published in the census reports. The impact of socio-economic, natural and cultural factors on the regional differences of infant and child mortality – in the rural and urban setting – are discussed. Chapter 6 is based on the analysis of individual census data for urban Ethiopia, with special reference to the situation in Addis Ababa. The impact of socio-economic variables and housing conditions at the individual level is studied here and especially vulnerable groups are identified.

# CHAPTER 2
# DETERMINANTS AND MEASUREMENT OF INFANT AND CHILD MORTALITY

## 2.1 Determinants and 'mechanisms' of infant and child mortality

In developed countries, where both infant and child mortality are relatively low today, the deaths of infants or children are in most cases due to causes which are impossible or very difficult to reduce. In particular, most infant deaths are due to "endogenous" causes, that is congenital anomalies or other conditions originating in the perinatal period, frequently associated with short gestation and low birth weight. As for child mortality, whose level is usually almost negligible in developed countries, the main causes are accidents and cancers. The constant progresses of the medical science and the various social campaigns aimed at reducing road or home accidents may lead in the future to further reductions in the already low levels of infant and child mortality, but the room for improvement is probably limited.

In developing countries where, on the contrary, infant and child mortality are still relatively high, the large majority of infant and child deaths could be avoided by adopting effective prevention strategies and providing appropriate health care. In order to obtain the best possible results in the reduction of infant and child mortality, it is fundamental to know the mechanisms leading to the children's death, so that policy-makers can target the available resources to those interventions that guarantee the highest reduction of mortality. However, this is often a difficult task, because while in some cases it is relatively easy to identify a specific disease or accident as the cause of death, more often the death is only the ultimate outcome of a series of situations and/or of events. Moreover, in addition to epidemiological and biological factors, socio-economic factors and the physical environment play a fundamental role. In fact, the living conditions of children, in terms of nutrition, hygiene, access to health care, housing characteristics and environmental factors, have a strong impact on the risk of contracting diseases or having an accident and, eventually, of dying.

In order to study and understand the mechanisms which are behind infant and child mortality in developing countries, it is therefore necessary to consider together in a comprehensive framework the two dimensions of the phenomenon: the biomedical one and the socio-economic one.

Several scholars in the past decades have proposed various conceptual frameworks of this type. In 1980, Meegama proposed two models respectively for neonatal and post-neonatal mortality. In these models, the causes of death were first aggregated in broad categories and then, for each category, the main risk factors were identified. Starting from these factors, the chains of causal relations were reconstructed up to the level of the primary determinants, which were mainly bio-demographic characteristics of the mother and socio-economic factors. One of the limitations of these models was that only "one way" relations were specified, while in some cases there are "two way" interactions which play an important role: a classical example is the interrelation between malnutrition and morbidity (Martorell and Ho, 1984).

In the course of the 1980s, Mosley and Chen proposed a new analytical framework that combines the methodologies of the social and medical sciences. According to this approach, the socio-economic determinants (or independent variables) exert an impact on child mortality through a number of intermediate biological determinants, called proximate determinants (Mosley and Chen,

1984). The action of the proximate determinants results in the onset of diseases and nutritional deficiencies while in the long term the cumulative effect of these diseases lead to growth faltering and ultimately mortality. Child mortality is therefore studied more as a chronic disease process than as an acute phenomenon. As a dependent variable Mosley and Chen propose an indicator which combines the levels of growth faltering and mortality. The socio-economic determinants are grouped by the authors in three broad categories: individual-level variables (including individual productivity of fathers and mothers, determined by skills, health and time, as well as traditions, norms and attitudes); household-level variables (including income, wealth and households' assets); community-level variables (including ecological setting, political economy and health system). Finally, as proximate determinants the authors proposed fourteen variables (all deemed measurable in population based research) grouped in five categories: maternal factors, environmental contamination, nutrient deficiency, injury, and personal illness control.

The model proposed by Mosley and Chen became a classical reference for the researchers in this field. Compared to previous models, in fact, the relations between independent and intermediate variables were clearly defined and interactions were taken into account, although the causal relations were not explicitly analysed. Some authors tried to build up on the proximate determinants framework. For instance, Akoto (1985) proposed two models on the determinants of infant and child mortality respectively, which were inspired by the proximate determinants framework, but the main categories of causes of death were specified and the main "causal paths" were also indicated, in a way similar to the one proposed by Meegama.

Although the proximate determinant framework can be considered a good approach from a theoretical point of view, unfortunately it is difficult to adopt in practical terms because data on many of the proximate determinants are rarely available for developing countries. Therefore, most studies conducted on infant and child mortality are limited to a partial analysis of the phenomenon, focussing on some of the socio-economic factors or on specific biomedical mechanisms.

Many studies have been dedicated to the association between infant and child mortality and various socio-economic variables. It is commonly known, in fact, that in most developing countries variables like economic status, education, area of residence, ethnicity and religion are usually correlated with infant and child mortality. Unfortunately, these variables are also usually highly correlated to each other and therefore it is necessary to verify what is their net effect after having controlled for the other variables. A not so easy undertaking. Even in the case of a variable with a direct association with mortality, it is very difficult to identify the mechanisms (causal paths or proximate determinants) explaining this association. The most typical example is represented by the mother's education, a variable that is usually highly correlated with mortality: the higher the mother's education, the lower the risk of mortality. Although some authors found that the effect of mother's education was substantially reduced when controlling for other variables (Cantrelle at al., 1986; Cleland and Van Ginneken, 1989), the majority of the studies seem to suggest that mother's education is the socio-economic variable most correlated with infant and child mortality.

Several authors attributed to the educational attainment of the mother a central role and a relevant net effect on mortality (Caldwell, 1979; Mensch et al., 1985), while others considered that variable as a proxy for the "cultural and behavioural change" (Ewbank et al., 1986) or, in general, for the level of development (Ware, 1984).

Various hypotheses have been formulated to explain the association between mother's education and infant and child mortality. For instance, Caldwell (1979) suggested that educated women are less fatalist in relation to the disease, are more confident and use more frequently health care services, have a more important role in the family and pay more attention to child care and nutrition, but these hypotheses were not tested because of lack of relevant data. Antoine and Demba Diouf (1988) found that mother's education has an influence both on the prevention and on the cure: on one side educated mothers pay more attention to hygienic norms, vaccinations and preventive care, on the other side they are more likely to seek health assistance in case of disease and are more successful in following the required therapy and obtaining the medicines.

Since the early 1990s, the availability of data from the Demographic and Health Surveys allowed to test some of these hypotheses with data from several developing countries. Using these data, Bicego and Boerma (1991) found that educated women are more likely to receive prenatal care and to vaccine their children, who are also less frequently undernourished and suffering from diarrhoea compared to children of uneducated women. Several studies have been conducted to verify if the positive effect of mother's education is due to the knowledge of specific behaviours or rules (learnt at school or outside the school) or to the different status and higher self-confidence acquired as a consequence of being educated. Some authors attributed more importance to the first "path", considering the ability to read and receive information the key point (LeVine et al., 1994). Others privileged the second "path", considering the acquisition by the woman of a social identity the key point (Caldwell, 1990; Kaufmann and Cleland, 1994). Finally, Joshi (1994) attributes importance to both explanations. Valente (1997), using DHS data for Mali, Senegal, Kenya and Uganda, found that mother's education was the most important socio-economic determinant of post-neonatal mortality (from one month up to two years of age) in all countries. Moreover, the reduction in mortality risk associated with mother's education was stronger in urban than in rural areas. For non-educated women, on the contrary, the mortality risk was higher in urban than in rural areas. According to the author, non-educated women living in urban areas cannot count on the enlarged family support and on solidarity networks typical of rural society. At the same time, they are not able to take advantage of social and healthcare services available in urban areas because they are not well integrated in the urban social and economic system. The result is relatively high child mortality. Educated women living in urban areas, on the contrary, are able to take fully advantage of the social and healthcare services, and this results in a substantial reduction in child mortality.

If mother's education is often considered the most important socioeconomic determinant of infant and child mortality, also father's education, economic status and several others socioeconomic variables are usually associated with the levels of infant and child mortality. Religion, ethnicity and region of residence are among the socioeconomic variables that most often are highly associated with infant and child mortality. Unfortunately, these variables are usually correlated between themselves and it is generally very difficult to assess the net effect of each of them.

Among the studies which focussed not on the socio-economic variables but on the biomedical mechanisms of infant and child mortality, many have been dedicated to the impact on mortality of factors like mother's age, parity and timing of births. Hobcraft (1994), for instance, demonstrated that children born to very young mothers or following very short intervals after the previous birth are at very high risk of mortality, even controlling the effect of other variables. A special role is

played, in this context, by breastfeeding. It has been demonstrated that breastfeeding contribute to child survival in different ways: not only breastmilk provides the best nutrient source for children and helps to develop their immunologic defense system, but it has been demonstrated that breastfeeding contributes to child survival also by lengthening intervals between births, through hormonal changes which delay the resumption of ovulation in the postpartum period (Huffman and Lamphere, 1984). In other words, breastfeeding contributes both to the health of the child being breastfed and to the health of the next child (Hobcraft, 1994).

Other studies have investigated the role played by environmental risk factors. A study on West Africa conducted by Gaigbe Togbe (1994) showed the high correlation existing between environmental factors (like the quality of water supply, the availability of a toilet and the level of hygiene), the risk of contracting various infectious diseases and infant and child mortality. This study showed that the relative importance of these factors depends on the geographic characteristics of the region and on the type of human settlements. For instance, the availability of piped water has a stronger effect on infant and child mortality in regions where water is scarce. Similarly, the presence of a toilet has a stronger effect on infant and child mortality in urban, densely populated areas than in rural areas. Apart from water and sanitation, other environmental factors like altitude, climate, various characteristics of the dwellings and crowding have often been found associated with infant and child mortality.

Finally, many studies on infant and child mortality have been dedicated to specific diseases, analysing the risk factors, the aetiology, preventive and curative aspects, consequences on health status in the short and long term, etc. In most cases, these studies showed that mortality could be substantially reduced by adopting relatively simple and inexpensive prevention strategies and providing appropriate health care.

One of the most widespread diseases and one of the main causes of death in many developing countries is diarrhea, a term which is widely used to indicate a variety of diseases which are caused by different pathogens and which have different modes of transmission. The prevalence of diarrhea can be reduced by improving nutrition (especially encouraging breastfeeding) and promoting the use of safe water and the adoption of personal hygienic measures. On the therapeutic side, the most serious consequence of diarrhea, which is dehydration, can be cured through oral rehydration therapy (ORT).

Among the other major causes of morbidity and mortality in developing countries, not only among children, some are preventable by immunisation (including neonatal tetanus, pertussis and measles), while others could be cured with low-cost drug therapy (including pneumonia and other acute respiratory infections) (Foster, 1994).

## 2.2 Estimation techniques of infant and child mortality

In countries where vital registration systems exist and are reliable, demographic parameters like fertility or mortality rates (including infant and child mortality rates) can be easily calculated adopting standard demographic techniques. Unfortunately, in most developing countries (including Ethiopia) vital registration systems do not exist or are affected by severe underreporting or

misreporting, which may lead to estimates seriously biased. For instance, when a child dies shortly after the birth, often the two events (birth and death) are not recorded, resulting in underestimation of infant mortality.

One solution to the problem of estimating infant and child mortality in countries with absent or poor registration systems is represented by the so-called "direct estimates" based on retrospective maternity histories. The information necessary to calculate these estimates is usually collected in the World Fertility Surveys or in the Demographic and Health Surveys. All women report the dates of birth of every child and the dates of death (or age at death) for those who died. Using these data, infant and child mortality can be estimated. However, several factors can affect the results: misreported dates, rounding of ages at death (or "heaping"), omission of reporting of dead children and, in general, memory problems, especially for aged women who had their children many years before the survey. Moreover, the estimates are available only for the countries where a survey including the birth histories was carried out.

Since in many developing countries the only source of demographic information is the population census, demographers have been studying for a long time techniques for estimating demographic parameters indirectly, using information usually collected in censuses or which can be collected adding to the census forms specific questions. Several techniques for calculating "indirect estimates" have been developed, in particular, to estimate the levels of infant and child mortality using data on children ever born and children surviving classified by age of the mother or by duration of marriage.

One of the most known techniques of this type was proposed by Brass in the 1960s and then was further developed by the same Brass and by other authors. The technique allows to estimate the probability of dying before a certain childhood age (usually 1, 2, 3 or 5 years) from the proportion of dead children among those ever born to women in different age groups (respectively 15-19, 20-24, 25-29 and 30-34) applying specific multipliers which depend on the pattern of fertility. A detailed explication of this and other techniques of indirect estimation can be found in the Manual X of the United Nations on "Indirect techniques for demographic estimation" (UN, 1983). Among the improvements to the Brass method proposed in the Manual X, one allows to estimate the time to which the estimates refer. In fact, it is clear that the proportion of dead children to young women (on which the estimates of q(1) and q(2) are based) depend on the mortality prevailing in the years immediately preceding the census; on the contrary, the proportion of dead children to older women (on which the estimates of q(5) are based) depend on the mortality prevailing several years before the census.

Other improvements to the indirect estimate techniques refer to the formulation of questions, in order to minimise underreporting and misreporting. In particular, in order to reduce the risk that mothers "forget" to report children, who have died or left home, it is recommended that six questions are asked separately, on the number of boys and girls who died, on those who are living at home and on those who are living elsewhere.

# CHAPTER 3
# EXISTING KNOWLEDGE REGARDING INFANT AND CHILD MORTALITY IN ETHIOPIA

In the previous chapters reference was made to the issue of infant and child mortality in developing countries in general. Although it is true that the problem of persisting high levels of infant and child mortality concerns most developing countries, it is also clear that not only the levels of mortality, but also the causes and the characteristics of the phenomenon differ, often widely. In fact, the mechanisms of infant and child morbidity and mortality are influenced by geographical, climatic, social, cultural and economic characteristics that differ from one country to another and, very often, even among different regions of the same country. Therefore, prudence should be used when extending the results of a study to other populations, especially if there are substantial differences among the populations considered. For this reason, since this study focuses on infant and child mortality in Ethiopia, we try to summarise in this section the results of some of the various studies which have been carried out in the past 20 years on infant and child mortality in Ethiopia. This summary does not pretend to be an exhaustive review of the knowledge in this field, but, nevertheless, it can provide useful background information.

Unfortunately, the lack of pertinent and reliable data made it very difficult for the researchers to study and to explain the variations in infant and child mortality for the whole country. However, there have been several small-scale studies that have attempted to document the interrelationship between infant mortality and socio-economic and cultural characteristics. Most of these studies focus on specific geographic areas: Abate (1988), Enemanachew and Chaudhury (1994), Kassahun (1987) and Teshome and Chaudhury (1994) studied rural Ethiopia; Assefa (1991) and Tesfayesus (1973) focused on a specific region, while Mekonnen (1993), Tesfayesus (1985) and Yohannes (1990) considered selected towns; Gebre-Egziabher and Hogan (2000) reported on the situation of 1979-93 in the Tigrai region, and Shamebo et al (1993) report on a specific project area. Other studies to be mentioned are those conducted by Abdulahi (1988) and Genet (1987), in addition to the reports of the Central Statistical Authority and its predecessors.

We begin this review with the studies dedicated to socio-economic determinants. Abate (1988), using data from the 1969-71 and 1981 Ethiopian rural demographic surveys, found that the most important correlates of childhood mortality in rural areas were ethnicity, religion, region of residence, place of birth, disability status and literacy status of parents. The data also confirmed that ethnicity and religion were highly correlated and that they interacted with the region of residence, in their effects on child mortality.

As for the role of mother's education, the studies by Tesfayesus (1985), Kassahun (1987), Yohannes (1990) and Makonnen et al (2000) seems to confirm that the inverse relationship between the mothers educational attainment and infant and child mortality is valid also in Ethiopia. Education, as it was said in the previous chapter, not only influences infant and child survival in a direct way, but also indirectly through its association with a higher socio-economic status of the household, which then permits better household amenities and facilities contributing to the reduction of infant and child mortality. Mekonnen (1993) cites water supply and the availability of a

latrine as examples. Taking into account the direct and indirect effects of education on infant and child health and survival, this variable emerged as the most significant characteristic, which could be a specific target for policies.

Assefa (1991) and Tesfayesus (1985) could confirm the negative link between work status of women and infant and child mortality for selected Ethiopian towns. In the case of economically active women - in the modern sector - the number of children surviving is highest**.**

In their studies Tesfayesus (1985) and Abate (1988) showed the important role of economic well-being of the household for infant and child mortality, noting that the proportion of surviving children increased with increasing size of land, increasing number of live-stock or the number of Oxen available to work the land, since land holding and ownership of live-stock is the best measure of wealth in rural Ethiopia.

Assefa (1991), Abate (1988), Kassahun (1987) and Tesfayesus (1985) confirmed the importance of religion and ethnicity – categories reflecting traditions and norms – for the patterns of infant and child mortality in the case of Ethiopia. Abate (1988) observed in the case of 3 regions, out of a total of 12 Ethiopian regions, the loss of mortality advantages of female new-borns over males.

As for the biological determinants of infant and child mortality, birth spacing is confirmed as a key variable: the length of the time interval between births is an important factor of the probability of survival for both the preceding and the subsequent child (Mekonnen, 1993). Mekonnen also found that the survival of the preceding child has an effect on the probability of survival of the child and concluded that maternal and child health services should direct attention to persons or households most vulnerable, who experienced already the death of one child. According to Berhanu and Hogan (1998), the death of the previous child and the consequent interruption of breastfeeding has a strong effect on the resumption of menses, therefore it causes a shortening of the time interval between births and increases the death risk for the following child. Lindstrom and Betemariam (1999) confirmed that closely spaced births increase the probability of dying in the first months and years of life. They also attribute the negative effect of birth spacing in the Ethiopian context to the mechanism of resource competition between the index child and the later born. Certainly the length of breastfeeding has an important role. Makonnen et al (2000), using data on infants born in Jimma town in 1992, found that almost all infants were initially breastfed, and about 80% were still breastfed at one year. Lindstrom and Betemariam, (1999) also found that breastfeeding had beneficial effects up to eight months of age, but there is also evidence that prolonged breastfeeding, beyond the age of two years, is increasing the risk of child mortality.

The commonly found results on the relations between age at maternity, birth order and infant and child mortality are confirmed for Ethiopia by several studies, which report higher mortality for relatively young (under 20) and old mothers (over 35) (Mekonnen, 1993) and for first order and higher order (6 and more) births.

It was said before that the combination of mother's education and high economic status, two variables which are usually highly correlated, has a positive effect on infant and child survival. In fact, these "advantaged" households are more likely to have access to piped water and to latrine or flush toilet, and in addition pay more attention to hygienic norms, like washing hands (Makonnen et al. 2000). As a consequence, the risk of contracting infectious diseases is substantially reduced. Unfortunately, the sanitary conditions in Ethiopia are very often very poor. In a survey regarding a

rural peasant association in the Jimma region, the authors concluded that 'there is a great need for improvement in several basic health areas, including the environmental sanitary conditions… , as well as the fundamental health status of women and children.' (Surafel et al, 1995, p. 91). According to a study of morbidity patterns in the Butajira Rural Health project in central Ethiopia, sanitation factors were the principal risks for gastroenteritis (Shamebo et al, 1993). The authors also found that the most common diseases were acute respiratory infections and acute diarrhoea, and that parental factors such as illiteracy were linked to morbidity. Acute respiratory infections and acute diarrhoea, together with malnutrition, were also the most common causes of death in a study of infant and child mortality conducted in 1994-1995 in the north Gondar Administrative Zone (Mesganaw Fantahun et al, 1998). Freij et al (1979) investigated the associations between various individual and household characteristics and the prevalence of diarrhea in an urban area in Ethiopia. The main risk factors that emerged from their study were poor nutrition, housing, hygiene, sanitation and water supply. An ethnographic study of diarrhea in Southwest Ethiopia (Mirgissa and Fekadu, 2000) showed recently, that the causes of diarrhea are known only by a small percentage of mothers or caregivers: only 20.5 percent of them indicate "poor hygiene" while 23.4 percent indicate "evil eye" as the major cause for diarrhea.

Regarding the causes of infant and child mortality, the Country Health Profile prepared for USAID states: 'As throughout sub-Saharan Africa, the vast majority of child deaths in Ethiopia are preventable. Reportedly more than three-quarters result from vaccine preventable diseases or dehydration due to diarrhea… The 1988-89 survey in Butajira District found that ARIs (including measles and pertussis) and diarrheal diseases together accounted for over half of reported deaths among infants and children…' (Center for International Health Information, 1999, p.8 with reference to Shamebo et al. 1993).

We conclude this review with some results of studies on malnutrition and on the effects of famines. Malnutrition is, unfortunately, a very common problem in Ethiopia. According to a study conducted in Southern Ethiopia, for instance, 45 percent of children aged 3-36 months were stunted, 42 percent underweight and 12 percent wasted. Among the socio-economic factors, household economic status and women's education were important in explaining the variation in long-term nutritional status of children (Gugsa Yimer, 2000). Given this very high level of malnutrition, it does not surprise that the recurrent famines have very severe consequences (see section 1.2). Gebre-Egziabher and Hogan (2000) argue in a recent study, which focus on the Tigrai region, for the importance to take into consideration wars, famines, droughts and environmental degradation as an important factor to explain high levels of infant and child mortality. "The combination of these natural and man-made catastrophes not only destroyed food production, but also undermined social services, in particular health services. The already meager government resources were taken away from all other sectors to finance military build-ups. Economic activities such as traditional subsistence agriculture practices were disrupted. Other devastating effects of these catastrophes were uprooting people from their villages and breaking up families, creating a large urban refugee population." (Gebre-Egziabher and Hogan. 2000, p. 172).

# CHAPTER 4
# SOURCE AND QUALITY OF DATA AND METHODS OF ANALYSIS

## 4.1 Source of data

The results presented in this paper are based on data from the 1994 Population and Housing Census of Ethiopia. The Census covered the entire regions of the country, though the censuses of two regions were completed two and three years, respectively, after the Census date October 11,1994. The data of these two regions, namely Affar and Somali, are projected backward to make all data to refer to the single date, 11$^{th}$ October 1994. The Census employed a short and a long questionnaires. The short questionnaire was used to collect some basic information, which include relationship to the head of household, age, sex, religion, ethnic group, language and marital status. The long questionnaire was used to collect additional information, which include data on disability, education, economic participation, migration, fertility and mortality. Data on housing conditions were also collected using the long questionnaire. The long questionnaire was administered to 20 % of the conventional households. That is, one out of five households was selected using systematic selection procedures. The selection was done from a fresh list of households, which was prepared on a separate form. The listing was done three days prior to the main census. Residents of hotels, hostels and other collective quarters were always interviewed using the long questionnaire. On the other hand, homeless persons were interviewed using the short questionnaire. For the purpose of this study, only the sub-sample of respondents interviewed with the long questionnaire is used.

The long questionnaire of the census provides information of the total number of children ever born and of children surviving, which are fundamental to estimate the level of infant and child mortality. Brass type questions, that is, the number of children living at home, living elsewhere, and children dead by sex of the child, were used to collect the required information. The form of the questions fulfils international standards and should assure by itself a relative high quality of the information collected.

The housing component of the census urban long questionnaire includes questions on type of housing, building materials, sanitary facilities, and household amenities. However, the housing section of the rural long questionnaire did include only limited information. Besides, the housing conditions in rural areas are homogenous and hence the analysis in this report covers mainly urban areas, particularly Addis Ababa.

## 4.2 Data Quality

### 4.2.1 Quality of age-sex data

Though age is an easy concept to understand, when it comes to measurement, there are several problems. In the 1994 census of Ethiopia, the age of respondents was determined by asking what is your age in completed years. Misreporting of age is a common problem in developing countries. Very few parents keep record of the date of birth of their children and celebration of one's birthday or issuance of birth certificates is uncommon in Ethiopia and other countries of Eastern Africa. Age is in most cases imputed either by the respondents and/or enumerators on the basis of linking the probable age with some presumably known events. It may happen that some people even fail to give clues from which their age can be estimated. In such a situation, the estimation of age falls in the hands of the enumerators. Age data could also be affected when individuals of a given age have been missed or counted more than once. In view of these considerations, it is necessary first to evaluate the quality of age data before undertaking any analytical work.

There are several frequently used indices for checking quality of age data for detecting digit preference in age reporting: Myers', Whipple's, Bachi, Carrier, and Ramachandran (US Bureau of the Census, 1994). In this report, Whipple's index and Myer's index of digit preference are calculated and presented in Table 4.1.

Whipple's Index is a test usually employed to measure age preferences for terminal digit '0' and '5' as compared to other digits. If age data is accurate, value of Whipple's index is expected to be 100. The rating of the quality of age data for different values of Whipple's index is less than 105 highly accurate data; between 105 and 109.9 fairly accurate data; between 110 and 124.9 approximate data; between 125 and 174.9 rough data; 175 and above very rough data. Accordingly, the 1994 census age data of Addis Ababa as well as of the country total are relatively better reported in urban areas than in rural areas. The findings in Table 4.1 and Table 4.2 also show slightly better age reporting for males than females.

Table 4.1 Whipple's and Myers' Digit Preference Indices, Ethiopia and Addis Ababa 1994

| Method and terminal digits | Urban and rural | | | Urban | | | Rural | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Male | Female | Total | Male | Female | Total | Male | Female |
| **Ethiopia** | | | | | | | | | |
| Whipple's Method Index | 272 | 259 | 285 | 249 | 233 | 264 | 277 | 264 | 289 |
| Myers' Method | | | | | | | | | |
| 0 | 16.3 | 14.8 | 17.7 | 12.7 | 11.6 | 13.8 | 17.0 | 15.4 | 18.5 |
| 1 | -6.4 | -6.2 | -6.6 | -5.8 | -5.5 | -6.1 | -6.5 | -6.4 | -6.7 |
| 2 | -1.1 | 0.6 | -1.5 | -1.0 | 0.4 | -1.5 | -1.1 | -0.7 | -1.4 |
| 3 | -4.3 | -4.0 | -4.6 | -3.5 | -3.1 | -3.8 | -4.5 | -4.2 | -4.8 |
| 4 | -4.4 | -4.0 | -4.7 | -3.8 | -3.4 | -4.2 | -4.5 | -4.1 | -4.8 |
| 5 | 10.1 | 9.3 | 10.8 | 8.8 | 7.8 | 9.7 | 10.3 | 9.6 | 11.1 |
| 6 | -2.7 | -2.3 | -3.0 | -2.4 | -2.2 | -2.6 | -2.7 | -2.3 | -3.1 |
| 7 | -3.9 | -3.6 | -4.3 | -2.7 | -2.5 | -2.9 | 4.2 | -3.8 | -4.5 |
| 8 | 2.3 | 2.4 | 2.2 | 2.4 | 2.2 | 2.5 | 2.3 | 2.4 | 2.2 |
| 9 | -5.9 | -5.8 | -6.1 | -4.7 | -4.5 | -4.9 | -6.2 | -6.0 | -6.3 |
| Myers' summary index | 57.4 | 53.1 | 61.6 | 47.7 | 43.2 | 51.9 | 59.2 | 54.9 | 63.4 |
| **Addis Ababa** | | | | | | | | | |
| Whipple's Method Index | 206 | 195 | 218 | 206 | 195 | 218 | 241 | 215 | 269 |
| Myers' Method | | | | | | | | | |
| 0 | 9.5 | 8.6 | 10.3 | 9.5 | 8.6 | 10.2 | 13.9 | 11.6 | 16.4 |
| 1 | -5.0 | -4.7 | -5.4 | -5.0 | -4.7 | -5.4 | -6.2 | -6.1 | -6.4 |
| 2 | -0.5 | 0.1 | -1.1 | -0.5 | 0.1 | -1.1 | -0.4 | 0.2 | -1.1 |
| 3 | -2.6 | -2.2 | -3.0 | -2.6 | -2.2 | -3.0 | -3.1 | -2.9 | -3.5 |
| 4 | -3.1 | -2.8 | -3.5 | -3.1 | -2.8 | -3.5 | -3.8 | -3.3 | -4.3 |
| 5 | 6.4 | 5.7 | 7.0 | 6.3 | 5.7 | 7.0 | 7.7 | 6.5 | 9.0 |
| 6 | -1.9 | -1.9 | -2.0 | -1.9 | -1.9 | -2.0 | -1.9 | -1.0 | -2.8 |
| 7 | -1.9 | -1.8 | -1.9 | -1.8 | -1.8 | -1.8 | 2.9 | -2.4 | -3.5 |
| 8 | 2.6 | 2.2 | 3.1 | 2.6 | 2.2 | 3.0 | 1.6 | 2.0 | 1.2 |
| 9 | -3.4 | -3.3 | -3.5 | -3.4 | -3.2 | -3.5 | -4.9 | -4.7 | -5.1 |
| Myers' summary index | 37.0 | 33.1 | 40.8 | 36.8 | 33.0 | 40.4 | 46.6 | 40.8 | 53.3 |

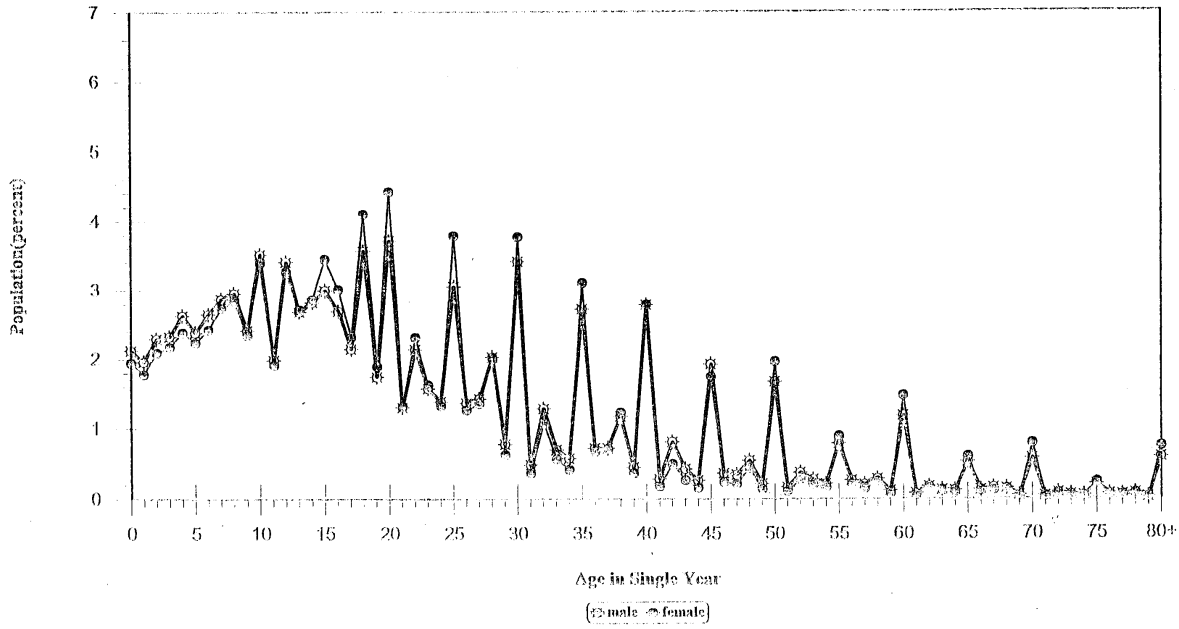
Source: Central Statistical Authority (1995 to 1998)

Myers' blended Index is usually used to measure the degree of preference for each digit and it provides a summary index for all terminal digits. The theoretical value of Myers' summary index ranges between 0 and 90; a value of 0 represents no age heaping, while a value would be 90 if all ages are reported as numbers ending in the same digit. The summary preference index for Addis Ababa is found to be 36.8 for both sexes combined, 33.0 for males and 40.4 for females. This shows, again, that single year age data of the 1994 census for Addis Ababa suffered from age heaping, and that the quality is relatively better for males than females. The situation at the country level is even worse. The Summary index for the country is 57.4, while for urban and rural areas it was found to be 47.7 and 59.2, respectively. In both urban and rural Ethiopia, the age data for men are relatively better reported than for women.

Regarding which digits are preferred or avoided, the data in Table 4.1 shows a tendency of both males and females to state their ages in digits ending in '0', '5' and '8' and avoiding ages ending in digits '1', '3', '4', '6', '7', and '9'. Digit '2' is also avoided by female respondents, but to a lesser extent. This finding is in line with previous data collected in Ethiopia (CSA, 1991). Put in order of preference, '0' is the highest preferred digit followed by '5' and '8' in that order. On the other hand '1' is the most avoided digit. The second most avoided digit is '9' followed by '4' and '3'. The result obtained concerning the degree of preference/avoidance is also reported for urban and rural areas.

Another problem in age data is age shifting. Age shifting/misreporting can best be studied from the progression of grouped age data. In this section the age pyramid is used once again to examine differentials in age shifting by sex. Mathematical tools such as age ratios, sex ratios, and UN Age-Sex Accuracy Index were applied only to the country data because the significant number of migrants to Addis Ababa (47.0 percent) and the recent observed decline in fertility violates the linearity assumption underlying the methods.

Figure 4.1 Population by sex and single years of age, Ethiopia - urban areas 1994



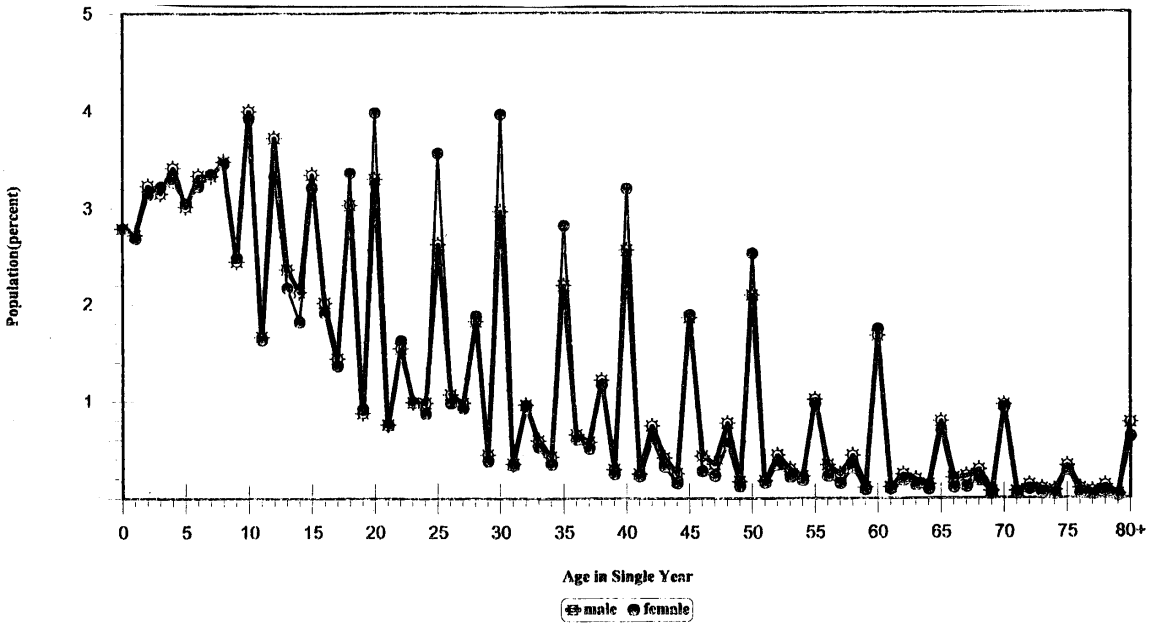

Source: Central Statistical Authority. 1999. The 1994 Census. Country level analytical report. p. 23

Figures 4.1 and 4.2 display the percentage distribution of the urban population by single years of age for Ethiopia and Addis Ababa. As the figures indicate there are undulations from age to age. The progression from age to age between age groups 15-19 and 35-39 is relatively fast and irregular. In the case of Addis Ababa, this is especially true for the female population. But, since a large proportion of Addis Ababa's population consists of migrants and there are some indications of recent fertility decline in Addis Ababa, it is difficult to discern whether these undulations are indicators of age shifting/misreporting or could reflect true nature of age-sex data. In the case of

data for all urban areas of Ethiopia the undulation applies to both male and female population similarly.

The age ratio index, sex ratio index and United Nations age-sex accuracy index (joint score) are given in Table 4.2. The age ratio index is the mean of the absolute deviation of the age ratios from 100 while the sex ratio index is the mean of the absolute successive difference of sex ratio in each age group. The joint score is obtained as three times the sex ratio score added to the two age ratios.

Figure 4.2 Population by sex and single years of age, Addis Ababa - urban and rural areas 1994




Source: Central Statistical Authority. 1999. The 1994 Census. Addis Ababa analytical report. p. 13

The UN age-sex accuracy index is interpreted as follows. An index of 40 and over is considered as highly inaccurate, while index values between 20 and 40 are labelled as inaccurate and values of less than 20 are considered as accurate. The UN age-sex accuracy index, which is 64.8 for Ethiopia, indicates that the age-sex data is in the category of highly inaccurate. Compared to rural areas, the age data for urban areas seem to be slightly better.

Table 4.2 Indices regarding age shifting by sex, Ethiopia 1994

| | Age ratio index | | Sex ratio index | UN age-sex accuracy index |
|---|---|---|---|---|
| | Male | Female | | |
| Urban | 9.8 | 17.7 | 9.5 | 55.9 |
| Rural | 13.8 | 19.8 | 12.0 | 69.7 |
| Urban and rural | 13.2 | 19.1 | 10.9 | 64.8 |

Source: Central Statistical Authority (1999)

4.2.2 Mean parity, proportion of children dead and sex ratio of children ever born

Before proceeding with the estimation of childhood mortality, it is important to check the consistency of the data by computing and examining the sex ratio of children ever born, the average parities and the proportion of children dead out of the total number of children ever born. The respective computed values are presented in table 4.3 in order to evaluate the consistency of the data.

As it is demonstrated in the literature, the expected value of the sex ratio at birth is approximately 105 (United Nations, 1983). Any value very far from this figure might be an indication of omission or inclusion of either of the sexes. In other words, a lower sex ratio may be an indication of omission of male children, while a higher sex ratio might be a result of omission of female children. As can be seen from Table 4.4 the overall sex ratio of Children Ever Born of Addis Ababa was near to the expected value. Even if its sex ratios fluctuate somewhat by mother's age, except for the age group 15-19 and 35-39 years, they lie within or very near to the acceptable range (102 to 107) without showing any systematic trend.

The sex ratio of children ever born of total and rural Ethiopia indicates a somewhat higher value than expected. Even if there is no systematic trend, there is an indication of omission of female children at all ages of mothers except for age groups 15-19 and 25-29 years. With the exception of the 25-29 age group, in all age groups of mothers, the sex ratios are higher than the expected value, and the over all sex ratio, 109, is also higher than the acceptable range. Thus, with respect to sex ratio, it can be said that there might be an omission of female children. However, in urban Ethiopia, the overall and age group specific sex ratios of children ever born lie in the expected direction

Table 4.3 Indices regarding children ever born, Ethiopia and Addis Ababa 1994

| Age group of women | Urban and rural | | | Urban | | | Rural | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean number of children ever born | Proportion of children surviving | Sex ratio at birth | Mean number of children ever born | Proportion of children surviving | Sex ratio at birth | Mean number of children ever born | Proportion of children surviving | Sex ratio at birth |
| **Ethiopia** | | | | | | | | | |
| 15-19 | 0.199 | 0.883 | 107.8 | 0.089 | 0.899 | 108.8 | 0.225 | 0.881 | 107.7 |
| 20-24 | 1.268 | 0.866 | 107.2 | 0.681 | 0.892 | 102.4 | 1.405 | 0.863 | 107.7 |
| 25-29 | 2.848 | 0.844 | 107.7 | 1.926 | 0.882 | 103.0 | 3.034 | 0.840 | 108.3 |
| 30-34 | 4.438 | 0.821 | 108.9 | 3.551 | 0.859 | 104.7 | 4.587 | 0.816 | 109.5 |
| 35-39 | 5.489 | 0.808 | 108.7 | 4.756 | 0.846 | 103.4 | 5.624 | 0.802 | 109.5 |
| 40-44 | 6.048 | 0.781 | 109.6 | 5.474 | 0.814 | 103.7 | 6.132 | 0.777 | 110.4 |
| 45-49 | 6.225 | 0.766 | 109.1 | 5.708 | 0.802 | 103.2 | 6.306 | 0.761 | 110.0 |
| 15-49 | 4.062 | 0.811 | 108.7 | 2.127 | 0.846 | 103.6 | 3.139 | 0.806 | 109.4 |
| **Addis Ababa** | | | | | | | | | |
| 15-19 | 0.044 | 0.917 | 120.8 | 0.043 | 0.919 | 121.9 | 0.117 | 0.834 | 81.0 |
| 20-24 | 0.369 | 0.916 | 101.3 | 0.362 | 0.917 | 101.1 | 1.204 | 0.867 | 110.8 |
| 25-29 | 1.294 | 0.908 | 103.7 | 1.282 | 0.909 | 103.5 | 2.536 | 0.856 | 117.8 |
| 30-34 | 2.831 | 0.898 | 102.8 | 2.815 | 0.899 | 102.8 | 4.276 | 0.837 | 98.6 |
| 35-39 | 4.280 | 0.881 | 100.4 | 4.264 | 0.882 | 100.3 | 5.794 | 0.852 | 109.9 |
| 40-44 | 5.033 | 0.857 | 101.2 | 5.013 | 0.858 | 101.3 | 6.589 | 0.789 | 97.2 |
| 45-49 | 5.582 | 0.844 | 102.2 | 5.571 | 0.844 | 102.1 | 6.614 | 0.810 | 112.9 |
| 15-49 | 1.666 | 0.879 | 101.9 | 1.655 | 0.880 | 101.8 | 2.822 | 0.833 | 106.4 |

Source: Own calculations

Another way of checking the quality of data on children ever born is by examining the trends of average parities by age of mothers. According to various arguments forwarded by scholars, 'unless fertility rose at some time in the past, average parities should increase with age up to age group 45-49' (United Nations, 1983). According to this test, the average parities of both Addis Ababa and country level indicate that the reporting of children ever born by mothers is consistent. Even if the trends of the average parities are generally acceptable, the very small increase in the average parities can be considered as an indication of some problems. But such trend has been generally observed in several surveys (United Nations, 1983).

The proportion of dead children by mother's age can also be used as a data quality check. As can be seen from table 4.3, the proportion of dead children increases with the age of mothers, and this can be considered as an indication of the absence of an increase of omissions of dead children by the age of mothers (United Nations, 1983).

In summary, available methods show that the age/sex data collected in the 1994 census was of low quality, with relatively better reporting for Addis Ababa than for the total country. Tests on the quality of data regarding children ever born and children surviving show, however, relatively good quality, especially, for urban Addis Ababa. The quality of the age data and data regarding children ever born and children surviving allow us to proceed with the analysis, even if there remain some reservations regarding data reported for rural areas.

## 4.3 Methods of analysis

The study employs both descriptive and multivariate statistical analysis. In addition, indirect techniques of demographic estimation are used to estimate the levels and trends of infant and child mortality.

The estimation of the levels and trends of infant and child mortality are based on the Brass-type questions. In the long questionnaire form of the 1994 Census, which was administered to 1/5 of the total population, the following questions were asked: (1) Children living in the household by sex of the child, (2) Children living elsewhere by sex of the child, and (3) Children dead by sex of the child. The underlying assumptions for the estimation of childhood mortality by the Brass technique are according to Palloni and Heligman (1985): (1) Constant fertility, (2) Mortality of children doesn't depend on the mortality of the mother, (3) Absence of age misreporting for mothers, (4) No under- or over-estimation of children ever born or dead, (5) The estimation is based on the correct model of mortality.

Taken all into account none of these conditions are completely satisfied. In addition the choice of the model life table influences the final estimates of infant and child mortality rates.

The infant and child mortality rates estimated in chapter 5 are based on the Coale and Demeney West Model (Trussell equations) and refer to average rates of the age groups 20-24, 25-29 and 30-

34, implicating reference to the years 1990-1992. In the descriptive analysis these infant and child mortality rates are estimated separately according to socio-economic characteristics of the women and characteristics of the household in which the women live.

Hazard models were not applied in this study of infant and child mortality as done in many previous studies, because the authors did not consider the 1994 census data suitable for this kind of analysis. Instead, the authors gave preference to an unbeaten path to identify vulnerable/less vulnerable groups with high/low infant and child mortality rates.

Consequently, in the second part of chapter 6 an attempt is made to group women according to some selected socio-economic and housing characteristics. A multiple correspondence analysis is performed on the different modalities of the selected variables. On the resulting factor values a cluster analysis in two steps is performed: n-cluster procedure to form 25 groups and than a hierarchical cluster analysis to refine the results and to establish 10 groups. The aim was to establish groups of women, which are as homogeneous as possible and as distinct from other groups as possible. Even though infant mortality was not one of the characteristics taken into account for the formation of the groups, the estimates of the infant and child mortality rates are very different between the groups. Nevertheless, a pitfall of this approach should be mentioned. The identification of significant groupings of Ethiopian women is based on a transversal view as offered by the census, whereas the estimates of infant and child mortality is based on a longitudinal view, and no change regarding the group belonging is assumed. To limit the significance of this problem no obviously longitudinal aspects, as, for example, age, marital status and relationship to the head of household, were used in the classification process. Nevertheless, caution is advised in the interpretation of the results.

# CHAPTER 5
# REGIONAL DIFFERENCES OF INFANT AND CHILD MORTALITY IN ETHIOPIA

Considerable regional differences in infant and child mortality rates do exist in Ethiopia. According to the estimates published by the Central Statistical Authority and reported in the Table A2 of the Annex, the lowest infant and child mortality rates are observed in Borena Zone; 73 infant deaths and a total of 101 deaths in the first 5 years of life per 1,000 live births. As shown in Figure 5.1 the other zones with low rates are Addis Ababa (78 and 109), the city of Bahir Dar (85 and 120) and Sidama (88 and 124). Whereas Addis Ababa and Bahir Dar are predominantly urban areas, Sidama (Southern Nations and Peoples State) and Borena (Oromiya) are predominantly rural areas.

The highest infant and child mortality rates are observed in Bench Maji (190 and 285) and adjacent zones in Southern Ethiopia Region: Northern Omo (154 and 231), Keficho Shekicho (153 and 229) and Jimma Zone of Oromiya Region with an infant mortality rate of 147 and a child mortality rate of 219. The corresponding national values are 116 and 171, respectively. The average infant mortality rates for rural areas is 121 (178 the child mortality rate), whereas 98 (140) in the case of urban areas. The regional patterns of infant and child mortality rates are very similar and, therefore, the following discussion can focus on the estimates of the infant mortality rates without loosing considerable information. The regional patterns of overall infant mortality rates are to a large degree influenced by the geographic pattern observed for the rural population, since 86.3% of the Ethiopian population lives in rural areas. As a consequence, no important differences in the regional patterns of overall infant mortality rates (Figure 5.1) and infant mortality rates of rural areas (Figure 5.2) are observed. The only areas with a predominantly urban population are Addis Ababa, Bahir Dar and Dire Dawa (see also Figure 5.5). The highest infant mortality rates of urban areas are observed in the peripheral zones of North-eastern and Northern Ethiopia, Benishangul-Gumuz and Gambella, Northern and Southern Omo, Western Harerge and Dire Dawa (Figure 5.3). Several of these zones are located in the lowlands. In most zones the urban areas have lower mortality rates than the corresponding rural areas, but some zones are not following this rule and the infant mortality rates of urban areas are higher than the one of rural areas: Western Tigray, Gambella and Dire Dawa. This could express real disadvantages or even problems linked to the data quality or measurement. As already mentioned in chapter 4 the completeness of reporting influences the estimates of infant and child mortality rates. It seems plausible that certain factors might influence at the same time the quality of reporting, as well as the levels of mortality. This has to be kept in mind in the following discussion of the regional patterns and their possible causes.

The estimates of the infant and child mortality rates refer to the results of the 20 to 34 years old women. Consequently results refer to the years 1990-92 and they might still be affected by the difficult social, economic and sanitary conditions due to the war.

The presentation of possible relationships between independent variables and the estimates of infant and child mortality as well as the correlation coefficients are presented in relation or weighted according to the number of women in the mentioned age group living in the zone. For example, in

the case of urban Ethiopia the observations for the capital city have not a weight of 1 in 41, which corresponds to 2.3%, but a weight corresponding to 33,0%. In Figures 5.4 to 5.10 each observation is presented through a symbol with a surface proportional to its population, or more precisely to the population of women 20 to 34 years old.

Most national and international studies indicate that usually a slight disadvantage for male life birth exist regarding mortality in the first years of life, and also later through life. Only in some special cultural situations, like for some Islamic countries, this disadvantage is reduced or vanishes. In Figure 5.4 the relation of male/female infant mortality rate is presented against the level of total infant mortality. In the Affar and Somali regions male infant mortality rates are lower than female rates. All other zones have a ratio above 1 indicating higher infant mortality rates for males than for females. Considerable geographic variations can be observed, whereas the level of infant mortality does not seem to influence the ratio.

The basic aim of the present report is to discuss and, eventually, measure the effects of socio-cultural and socio-economic differences on the level of infant and child mortality and to verify, if the housing conditions play an autonomous role in influencing infant mortality. Table 5.1 reports the correlation coefficients between some selected independent variables and the infant mortality rates. This analysis is focused on infant mortality, but an extension to child mortality would show the same results, because of the similarities in the estimation procedures.

The selected independent variables reflect the hypotheses discussed and formulated in the previous chapters. One key variable is the distinction between rural and urban population and areas. In the case of urban areas more detailed data are available and could be included in the analysis. These additional information concern especially the housing conditions and other information regarding the household, which are not collected for rural households or which show very little variability in rural areas. Additional information regarding climate – estimates of average temperature and rainfall – were made available by the Central Statistical Authority[2]. The information regarding climate are one of the natural conditions which are often used to distinguish the geographic regions of Ethiopia: the harsh mountains of northern Ethiopia, the temperate highlands of central Ethiopia, where most of the population lives and which offer better health conditions, and the arid and warm lowlands. Especially the malaria is one of the debilitating illnesses, which is endemic in many warm areas below 1,500 meters altitude.

As already mentioned, the percentage of population living in rural areas of a zone is an important predictor for the overall mortality level in the zone (Figure 5.5). Bahir Dar, a purely urban wereda, and Addis Ababa have relative low infant mortality rates. The zones of Dire Dawa and Harari have despite their urban status only average infant mortality rates. Without the information for Bahir Dar and Addis Ababa Figure 5.5 would not give a clear indication regarding the relationship between settlement type and infant mortality rates. The correlation coefficients in Table 5.1 show the positive statistical relationship between rurality and the mortality indices.

The quantitative imbalances between men and women in the age group 20 to 34 could influence the infant mortality rate of an area (Figure 5.6). The more this imbalance is in favour of women, the better women might be treated and as a consequence also their off-spring. A value of 1 indicates a balanced gender structure; values above 1 indicate more men than women in the age group. If the

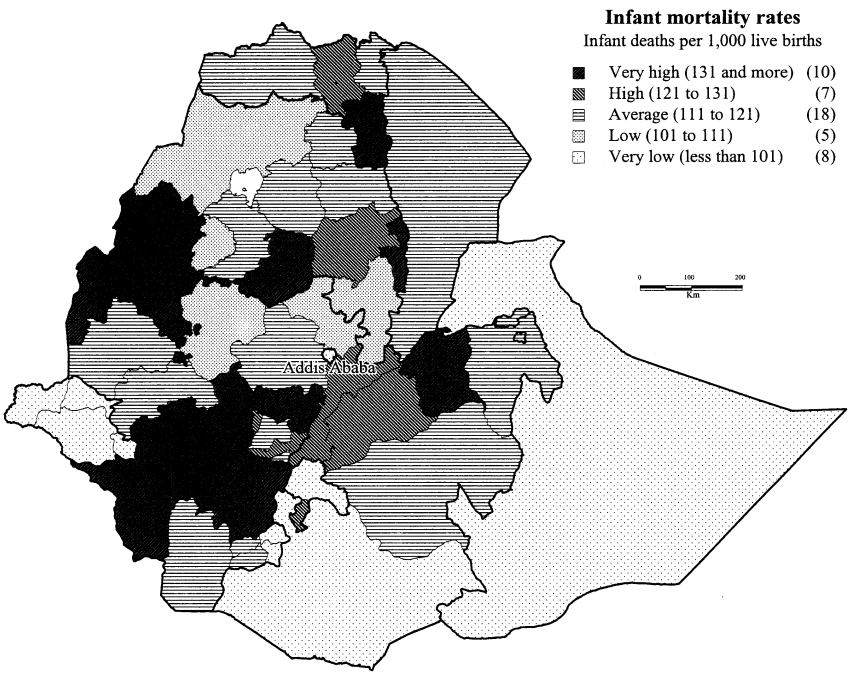
value is below 1 more women than men of the specific age group are living in this zone. The variability seems to be more important for the urban areas than for the rural ones. As expected, the scarcer the women the lower are the infant mortality rates. This tendency is confirmed by the systematically negative correlation coefficient, even if the relationship is rather weak with –0.361 in rural areas and –0.357 in urban areas.

Figure 5.7 indicates a negative relationship between the average size of the household and infant mortality. It is important to note that this relationship is independent of fertility, since the correlation coefficients between the estimated total fertility rates based on the 1994 census results (CSA, 1995-98) and infant mortality rate are close to 0 in rural areas and above 0.5 in urban areas. Larger families seem to have additional resources, perhaps just more time, available to care for children. But also other variables might be linked to this characteristic.

As already discussed earlier, the educational attainment of the population in general and especially of women has a predominant effect on the level of infant mortality. The percentage of women 20-34 years old with at least a primary education, corresponding to a minimum of six years of schooling, depends to a large degree on the settlement type. In most rural areas the educational attainment of the population in general and of women in particular is very low. On the contrary, in some urban areas the percentage of women 20 to 34 years old with primary education reaches considerably higher levels: 70.0 % in Harari and 65.5 % in Addis Ababa. Figure 5.8 shows that in urban areas the educational attainment of women is a good predictor of the level of infant mortality. The corresponding correlation coefficient reaches –0.892 with no significant variation between the gender specific infant mortality rates. In rural areas illiteracy is so common that educational attainment cannot be expected to correlate with regional variations of infant mortality rates.

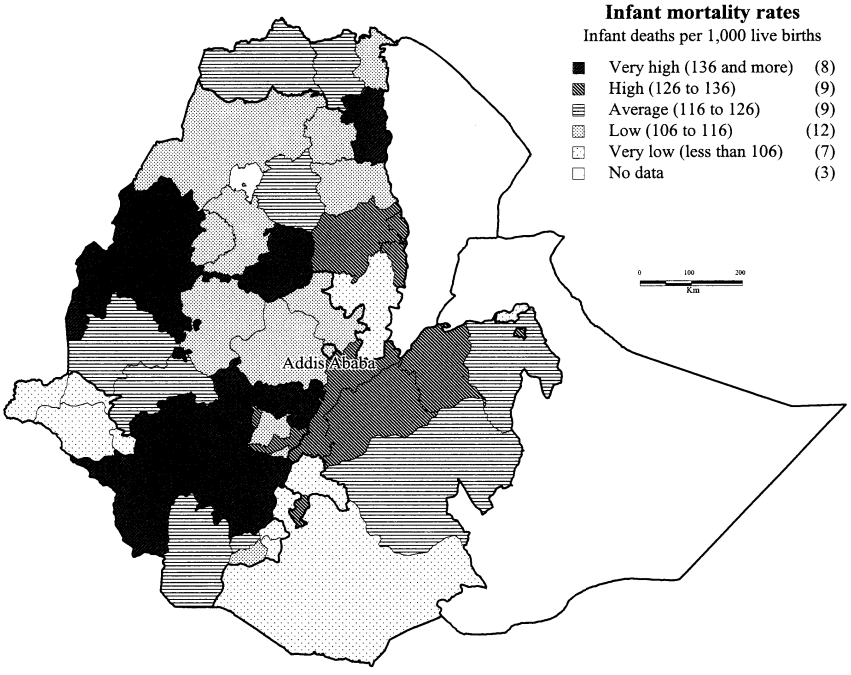
[2] The authors are indebted to Ms. Gezu Birhane for her help and advice.

Figure 5.1 Regional patterns of infant mortality, Ethiopia 1994



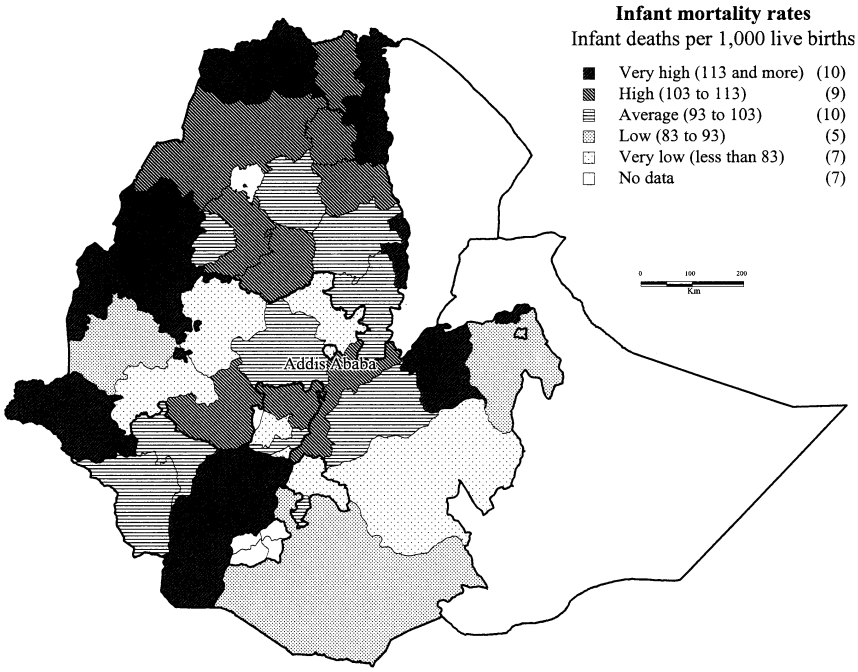

Note: Boundaries are approximate and unofficial

Figure 5.2 Regional patterns of infant mortality, rural Ethiopia 1994



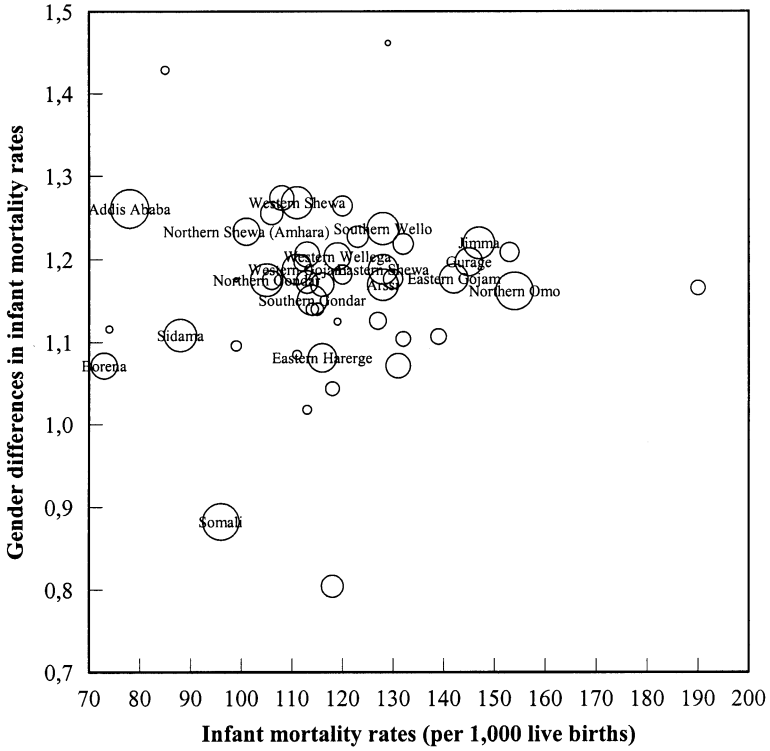

Note: Boundaries are approximate and unofficial

Figure 5.3 Regional patterns of infant mortality, urban Ethiopia 1994



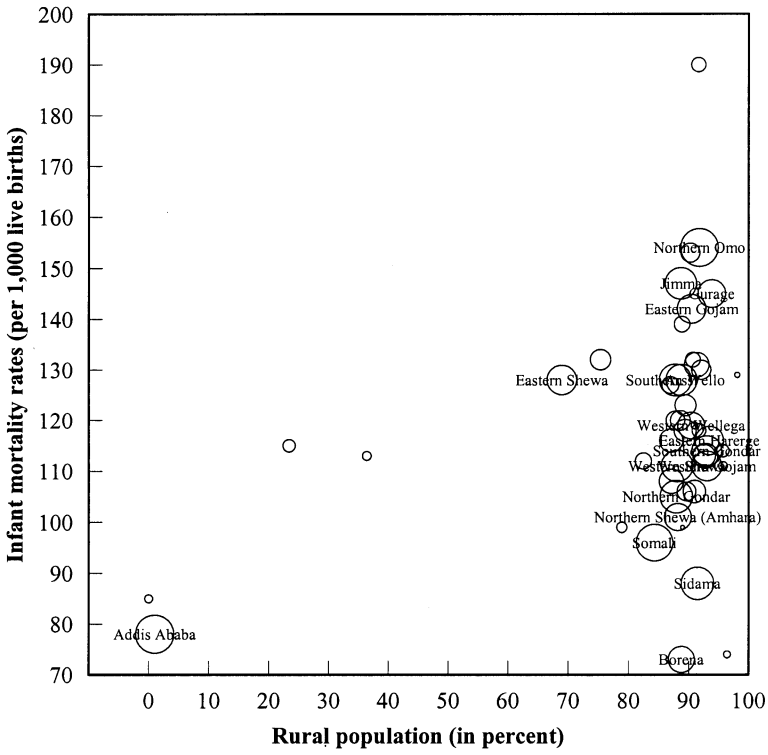

Note: Boundaries are approximate and unofficial

Figure 5.4 Level and sex differences of infant mortality of zones, Ethiopia 1994



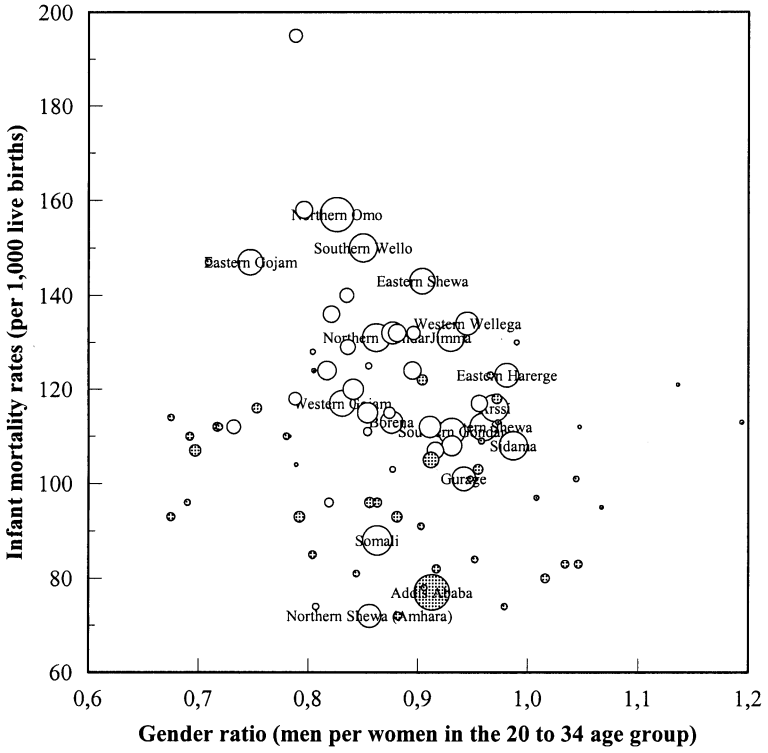

Symbols are proportional to the number of women 20-34 years old living in the zone.

Figure 5.5 Rural population and infant mortality of zones, Ethiopia 1994



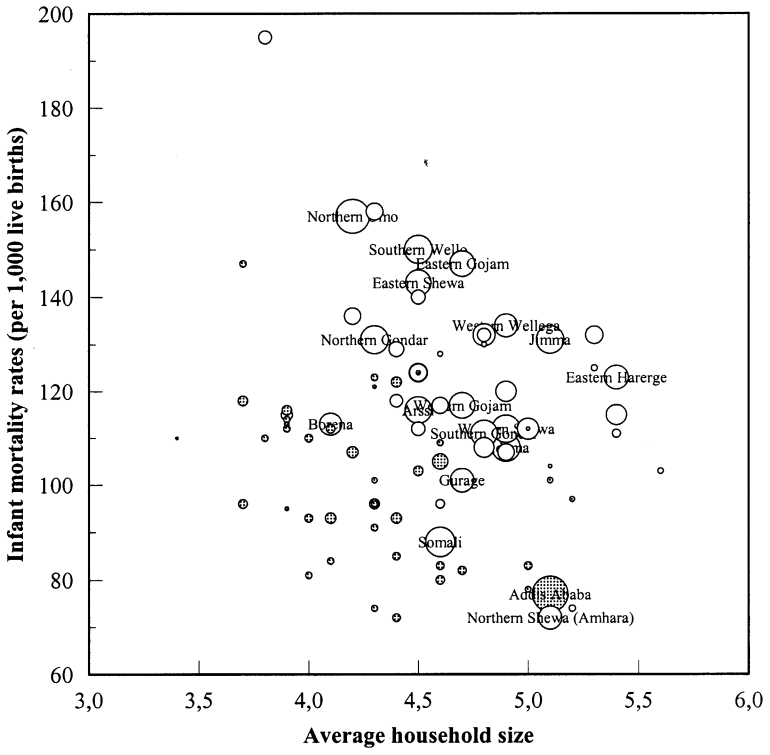

Symbols are proportional to the number of women 20-34 years old living in the zone.

Figure 5.6 Sex ratio and infant mortality, Ethiopia urban/rural zones 1994



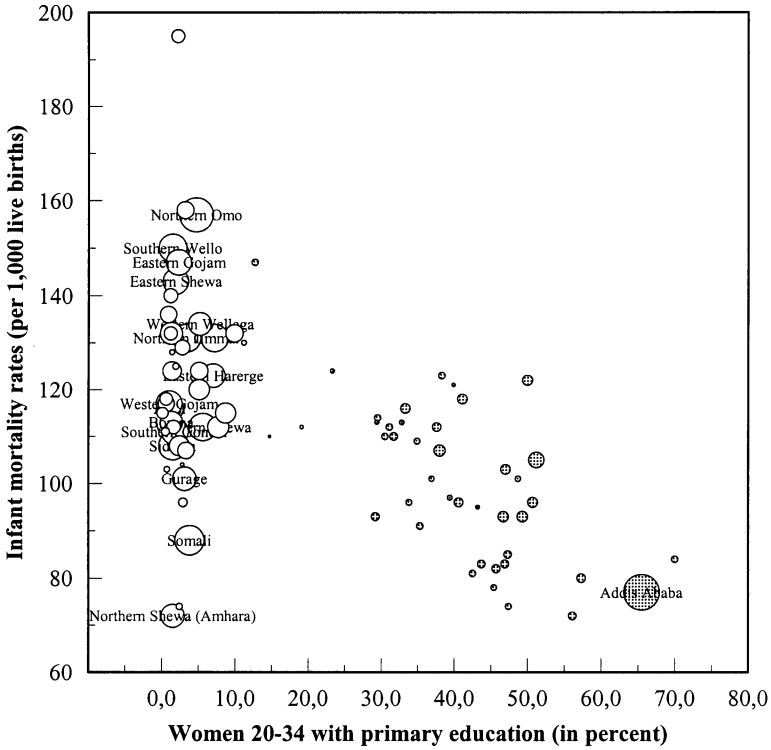

Symbols are proportional to the number of women 20-34 years old living in the zone.
Shaded symbols represent urban zones.

Figure 5.7 Average household size and infant mortality, Ethiopia urban/rural zones 1994



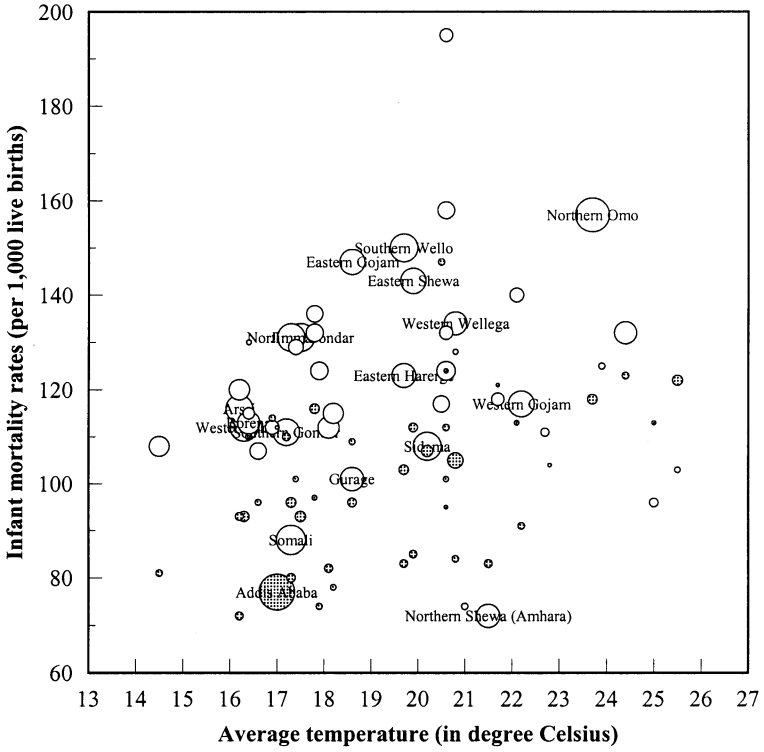

Symbols are proportional to the number of women 20-34 years old living in the zone.
Shaded symbols represent urban zones.

Figure 5.8 Women with primary education and infant mortality, Ethiopia urban/rural zones 1994



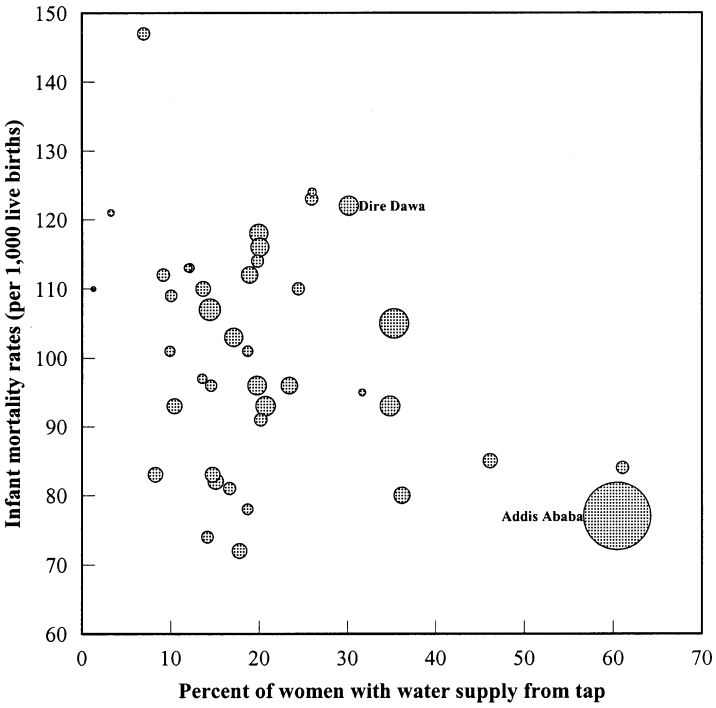

Symbols are proportional to the number of women 20-34 years old living in the zone.
Shaded symbols represent urban zones.

Figure 5.9 Estimated average temperature and infant mortality, Ethiopia urban/rural zones 1994




Symbols are proportional to the number of women 20-34 years old living in the zone.
Shaded symbols represent urban zones.

Figure 5.10 Water supply and total infant mortality rate of urban zones, Ethiopia 1994




Symbols are proportional to the number of women 20-34 years old living in the zone.
Shaded symbols represent urban zones.

The statistical relationship between the estimated average temperature of a zone and its infant mortality rate is positive for urban and for rural areas. The correlation coefficient is 0.340 in rural and 0.660 in urban areas. The difference between these two coefficients is somewhat a contradiction, since the population of rural areas should be more exposed and more sensible to environmental conditions. As indicated in Figure 5.9, the more temperate highlands have lower infant mortality rates, compared to the lowlands with average temperatures in the mid-twenty degrees Celsius.
Figure 5.10 focus on one aspect of the sanitary conditions in urban areas: the quality of the water supply, here the percentage of households with tap water in the housing or on compound. Even aggregate data show that the quality of the water supply is important. A protected water supply is an important step towards lower infant mortality rates of the urban area. The correlation coefficient is –0.662. The correlation coefficient regarding other amenities or more specifically their absence are all positive and are about of the same order.

The estimates of infant mortality for the urban areas of the different zones of Ethiopia and the independent variables were exposed to a more detailed analysis using a linear (multiple) regression analysis. In a certain way the results obtained were disappointing. The educational level of the population and the climatic conditions 'determine' the regional patterns of infant mortality. The regression results reported in Table 5.2 indicate that additional variables improve the $r^2$ in a minor way. For the third model the type of water supply was included, even if other amenities of the household would have yielded similar results. The effects linked to amenities and the sanitary conditions of the household are to a large degree already included in the effect linked to the variable 'female education' to 'explain' the regional patterns of infant mortality rates.

Table 5.1 Correlation coefficients between infant mortality rates and socio-economic variables, Ethiopia 1994

| Independent variables | Correlation coefficients between independent variables and infant mortality rates | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Rural areas | | | Urban areas | | | Total | | |
| | 45 observations/zones (4,502,000 women 20-34) | | | 41 observations/zones (927,000 women 20-34) | | | 48 observations/zones (5,837,000 women 20-34) | | |
| | Total | Male | Female | Total | Male | Female | Total | Male | Female |
| Women (20-34) in rural areas (%) | - | - | - | - | - | - | 0.439** | 0.384** | 0.476** |
| Men/women ratio (20-34) | -0.361* | -0.336* | -0.409** | -0.357* | -0.421** | -0.276 | -0.429** | -0.467** | -0.342* |
| Women (20-34) by religion | | | | | | | | | |
| - Orthodox (%) | -0.123 | -0.076 | -0.201 | -0.127 | -0.067 | -0.184 | -0.109 | 0.008 | -0.244 |
| - Muslim (%) | 0.270 | 0.246 | 0.304* | 0.219 | 0.174 | 0.252 | 0.134 | 0.023 | 0.268 |
| - Protestant and Catholic (%) | -0.214 | -0.229 | -0.170 | -0.102 | -0.133 | -0.062 | -0.095 | -0.094 | -0.098 |
| Population (20-34) by education | | | | | | | | | |
| - illiterate men (%) | -0.106 | -0.146 | -0.090 | 0.750** | 0.734** | 0.739** | 0.184 | 0.084 | 0.294* |
| - men 6+ years school (%) | 0.099 | 0.138 | 0.079 | -0.790** | -0.778** | -0.775** | -0.300* | -0.213 | -0.390** |
| - illiterate women (%) | -0.100 | -0.141 | -0.074 | 0.775** | 0.766** | 0.756** | 0.364* | 0.281 | 0.444** |
| - women 6+ years school (%) | 0.066 | 0.108 | 0.030 | -0.792** | -0.784** | -0.773** | -0.412** | -0.337* | -0.476** |
| Women (20-34) in households according to water supply | | | | | | | | | |
| - tap inside or compound (%) | - | - | - | -0.662** | -0.658** | -0.644** | - | - | - |
| - unprotected well/ river (%) | - | - | - | 0.377* | 0.372* | 0.371* | - | - | - |
| Women (20-34) in households according to lack of amenities | | | | | | | | | |
| - without kitchen (%) | - | - | - | 0.558** | 0.573** | 0.526** | - | - | - |
| - without bath (%) | - | - | - | 0.461** | 0.478** | 0.427** | - | - | - |
| - without toilet (%) | - | - | - | 0.593** | 0.613** | 0.555** | - | - | - |
| - without radio (%) | - | - | - | 0.654** | 0.650** | 0.637** | - | - | - |
| - without television (%) | - | - | - | 0.648** | 0.636** | 0.639** | - | - | - |
| Other census information | | | | | | | | | |
| Total fertility rate | 0.037 | 0.060 | 0.015 | 0.533** | 0.505** | 0.544** | 0.373** | 0.346* | 0.375** |
| Persons per room | -0.167 | -0.208 | -0.137 | 0.617** | 0.591** | 0.620** | 0.095 | 0.021 | 0.196 |
| Average household size | -0.430** | -0.427** | -0.425** | -0.733** | -0.704** | -0.732** | -0.460** | -0.492** | -0.375** |
| Climate | | | | | | | | | |
| Average temperature | 0.340* | 0.259 | 0.410** | 0.660** | 0.611** | 0.686** | 0.220 | 0.070 | 0.403* |
| Average rainfall | 0.313* | 0.374* | 0.252 | -0.446** | -0.406** | -0.471** | 0.274 | 0.386** | 0.114 |

Note: Correlation coefficients are based on observations for regions or zones weighted by the respective number of women 20 to 34 years old.

* - significant at the 5 % level

** - significant at the 1 % level

Table 5.2 Results of regression analysis of infant mortality, urban areas 1994

| **Different models** | **Results of regression analysis of infant mortality rate in urban areas by zone** | | |
|---|---|---|---|
| | Total | Male | Female |
| Model 1 | | | |
| Constant | 142.6 | 156.4 | 128.8 |
| Regression coefficient for female education | -0.987 | -1.046 | -0.928 |
| $_r^2$ | 0.628 | 0.615 | 0.598 |
| Model 2 | | | |
| Constant | 77.8 | 95.9 | 60.8 |
| Regression coefficient for female education | -0.790 | -0.862 | -0.721 |
| Regression coefficient for climate | 2.96 | 2.76 | 3.10 |
| $_r^2$ | 0.781 | 0.732 | 0.780 |
| Model 3 | | | |
| Constant | 95.9 | 115.6 | 77.0 |
| Regression coefficient for female education | -1.021 | -1.113 | -0.928 |
| Regression coefficient for climate | 2.84 | 2.63 | 2.99 |
| Regression coefficient for water supply | -0.302 | -0.329 | -0.270 |
| $_r^2$ | 0.818 | 0.769 | 0.812 |

Note: Female education: Percent of women 20-34 years old with at least 6 years of schooling
Climate: Estimated average temperature of zone
Water supply: Percent of women 20-34 years old with water from unprotected well or river.

The geographic pattern of gender differences in infant mortality in Ethiopia as reported in Figure 5.4 seem not to be related to cultural or religious differences between the zones. Results of a correlation analysis, not presented in detail here, show only slightly significant independent variable are the climatic variables, with negative correlation coefficients. Based on the regional analysis it can be concluded, that cultural and ethnic factors do not play a role in gender differences of infant and child mortality.

# CHAPTER 6
# INFANT AND CHILD MORTALITY IN THE URBAN SETTING

In this chapter the analysis of infant and child mortality in urban Ethiopia is based on individual data. The first part of this chapter offers a descriptive analysis of infant and child mortality according to the socio-demographic characteristics of women and their housing conditions. In the second part of the chapter, 6 groups or clusters of women with similar socio-demographic and housing characteristics are formed and subsequently the infant and child mortality rates for these groups are estimated. In the present chapter urban areas of Ethiopia are subdivided into 3 categories: urban areas with less than 20,000 inhabitants, urban areas with 20,000 or more inhabitants and the capital city Addis Ababa. The analysis in this chapter focus on women in the age bracket 20 to 34 and based on the number of children ever born and children surviving infant and child mortality rates were estimated. These estimates – probability of new-borns to die before the end of their first year of live (1q0) and probability of one year olds to die before their $5^{th}$ birthday (4q1) – were produced with the software MortPak-Lite (United Nations, 1988).

## 6.1 Infant and child mortality and individual characteristics of women and housing conditions

This chapter of the report presents a descriptive analysis of the effects of women's characteristics and housing variables on infant and child mortality. It is divided into two sections. The first section focuses on the relationship between socio-demographic and socio-economic characteristics of women and infant and child mortality, and the second section discusses the effects of housing variables on infant and child mortality. The estimated infant and child mortality rates are reported for urban areas and separately for the 3 urban-size categories in Table 6.1. In this table no information regarding gender differences are provided. In Table 6.2 the estimates for the urban areas of the capital city are presented with details regarding the gender of the child. Table A3 in the annex presents information regarding the quantitative importance of the different categories, which allows a better appreciation of significance of the differences in mortality rates.

### Individual characteristics of women and infant mortality

In this section the differentials of infant and child mortality according to the socio-demographic and socio-economic characteristics of women are reported. The variables included are religion, ethnic group, migration status, marital status, educational attainment and occupation of women.
The results reveal that the level of infant mortality is about 98 deaths per 1,000 live births in the urban areas of Ethiopia, with rates of 108 in urban areas with less than 20,000 inhabitants, 95 in urban areas with 20,000 and more inhabitants and 76 deaths per 1,000 live births in Addis Ababa. It has been also noted that there are significant gender differences in infant and child mortality. As

shown in Table 6.2, in Addis Ababa infant mortality is estimated at 87 deaths per 1,000 live births for male infants and at 67 deaths per 1,000 live births among females.

Whereas for urban areas the difference between Orthodox and Muslim is considerable (94 to 113), for Addis Ababa no important difference in infant mortality between the Orthodox and Muslim women is observed. Orthodox have an infant mortality rate of 77 against a rate of 82 for Muslim. However, Christians other than Orthodox seem to a have relatively low infant mortality rate in all categories, but it has to be noted that their share of the total population is rather small with about 7 %.

Regarding the relationship between infant mortality and ethnic group, the results in the tables indicate that women belonging to the Amhara and Tigreway ethnic groups, with 68 and 70 infant deaths per thousand, respectively, have the lowest rates in Addis Ababa compared to the other major ethnic groups of the city. They are followed by the Guragie with an infant mortality rate of 82. Oromo women and women classified as "other" ethnic groups are the most disadvantaged ethnic groups in terms of infant and child mortality. In urban areas with 20,000 inhabitants and more the Tigreway ethnic group looses its advantages and moves to an average position. In small urban areas Amhara, Guragie and Oromo have rates close to the average, whereas Tigreway and others have significantly higher rates. As a result, the information regarding the ethnic affiliation gives no consistent indication regarding its relationship with infant and child mortality.

The migration status of women seems to have only a very modest impact on infant mortality rates. As expected, recent migrants have somewhat higher infant and child mortality rates, amounting to 108 infant deaths per 1,000 live births for all urban areas and to 88 for the capital city. The corresponding rates for long time migrants and non-migrants are consistently lower. Since the majority of migrants are from rural parts of the country, it is not surprising to see higher infant mortality rates among migrants. Migrants, especially recent migrants, are expected to have lower educational attainment and lower economic status.

Educational attainment or years of schooling[3] is the single variable, which shows the most significant differences in infant and child mortality. Illiterate women have in all urban size classes high rates. Already a few years of schooling lower infant and child mortality rates considerably. Data in the Tables 6.1 and 6.2 show a strong positive relationship between educational attainment and infant mortality. The rates vary from 124 for the illiterates to 48 for the educational level "secondary and above" at the national level and 110 to 41 in the case of Addis Ababa. This observation is an indication that the settlement size by itself has little effect on infant and child mortality, but that the variation in the composition of the female population according to the educational attainment is a key variable. The percentage of illiterate women declines with settlement size from 51.1 to 32.3, and 17.8 % in the case of Addis Ababa (Table A3). This finding is in line

[3] The information regarding educational attainment measures in fact the years of schooling: primary education signifies 1 to 6 years of schooling, junior secondary are 7 or 8 years of schooling and secondary and above signifies 9 years of schooling and more.

with the general expectation regarding the power of education in improving the practice of mothers with regard to sanitation, childcare and nutrition.

Infant mortality is lower among currently married women as compared to the other marital status categories. The rates for currently married women in urban areas is found to be 84 (nationally) and 64 (capital city) deaths per 1,000 live births while that of never married women and widowed women are 98 and 109 (nationally) and 83 and 85 (Addis Ababa), respectively. The rates for divorced women are the highest, amounting to 121 and 91 infant deaths per 1,000 live births for all urban areas and for Addis Ababa, respectively. This shows that the relatively low level of standard of living is attenuated for currently married women, who have someone to share the economic burden of life. The impact of loosing the husband on infant mortality is more pronounced among the divorced women than among the widowed.

The occupational status of women is closely related to the educational attainment. According to expectations, working women who are engaged in legislative, managerial or professional jobs are better off than those working in service or sales activities and in elementary occupations. The rates for the latter are more than double that of the former. On the other hand, infant mortality rates among the non working (unemployed plus non active) women is found to be relatively better than that of women involved in services or sales activities and in elementary occupations. This might partly be due to the fact that women who declare themselves unemployed, and who are largely housewives, have more time to spend with and for their children, compared to those engaged in tiresome elementary occupation. This could shows that the income generated by working in services or sales activities and elementary occupations are over-compensated by the extra time women would have if they remain unemployed or inactive. But in many cases women in these situations will not have any choice.

Housing characteristics and infant mortality

The housing environment in which children are living and growing up has a significant impact on their health. In this section, the relationship between some selected housing characteristics and infant mortality is examined. The housing variables included in the analysis are: materials used for the construction of the floor, sources of drinking water, types of kitchen, type of bath, type of toilet, the density of occupation (persons per room) and the economic status of the household. The effects of housing characteristics on infant and child mortality are linked to some extent to the economic status and to some extent to the sanitary conditions. Theses two effects are usually intertwined and any attempt to separate them seems difficult. So the categories included in the present analysis are in part strictly linked to the sanitary conditions, whereas others underline the economic aspect. But in most cases the improvement of the sanitary situation of the household depends on adequate financial resources. In particular, the differences in the level of infant mortality are much higher with respect to the type of toilet available in housing unit.

Regarding the building materials used in the construction of the floor of the house, the results of this analysis show that infants in the mud floor houses are the most disadvantaged with 106 infant deaths for all urban areas and 90 infant deaths per 1,000 live births in Addis Ababa. The corresponding infant mortality rates in the case of the homes with tiles or cement floor are 70 and 58 infant deaths per 1,000 live birth.

The source of drinking water is linked to the cleanliness of the water, which has a direct bearing upon the health of the child. Specifically, in a situation where sanitary conditions of the housing unit and the surrounding environment are poorly maintained, drinking water fetched from some distance outside the compound is likely be exposed to agents of contamination. As expected the level of infant mortality is highest in the households whose source of water is a well or a river, something very rare in the case of Addis Ababa, but still fairly common in other urban areas. Evidently the lowest infant mortality rates can be observed for women in households with water from tap located inside the home or inside the compound: 90 infant deaths per 1,000 live births in small urban areas, 68 in large urban areas and 61 infant deaths per 1,000 live births in the capital city.

One of the major causes of infant mortality in Ethiopia is acute respiratory infection. Keeping children away from the agents of respiratory infections, such as smoke and dust, is an important step towards reduction of infant mortality. In this connection, the type of kitchen available is an important indicator of the extent of smoke creation in the household. The level of infant mortality is higher for the housing units which have traditional shared kitchens, where wood and charcoal are used for cooking, and others which did not have kitchen at all. It has to be noted that most of the housing units, which did not have a kitchen, consist of single room houses, which are obliged to use the same room for cooking. In small urban areas this category has an infant mortality of 127, in larger urban areas the value is 115, whereas in Addis Ababa the infant mortality rate in the households with no kitchen is 86 infant deaths per 1,000 life births. The availability of a modern kitchen is still rather uncommon and a sure sign of wealth of the household. The type of kitchen might be also linked to the hygienic standards in the preparation of meals and the risks of gastrointestinal illnesses.

The type of bathing facilities and the type of toilet indicates the sanitary conditions of a household. The results regarding the availability of bathing facilities show a marked difference in the level of infant mortality between housing units that have a bath or a shower (66 per 1,000 at the national level and 45 per 1,000 in Addis Ababa) and those without a bath or a shower (100 per 1,000 nationally and 79 per 1,000 in Addis Ababa). The level of infant mortality observed for women in households with no toilet reaches 119 deaths per 1,000 live births for all urban areas and is still 98 in the case of the capital city. Instead the corresponding infant mortality rates for women in households with a private toilet are respectively 78 and 53 deaths per 1,000 live births.

Table 6.1 Infant and child mortality rates by various characteristics, urban Ethiopia 1994

| Socio-demographic, socio-economic and housing characteristics | Total urban areas | | Urban areas with less than 20,000 inhabitants | | Urban areas with 20,000 inhabitants or more | | Addis Ababa | |
|---|---|---|---|---|---|---|---|---|
| | $_0q_1$ per 1,000 | $_1q_4$ per 1,000 | $_0q_1$ per 1,000 | $_1q_4$ per 1,000 | $_0q_1$ per 1,000 | $_1q_4$ per 1,000 | $_0q_1$ per 1,000 | $_1q_4$ per 1,000 |
| **Religion** | | | | | | | | |
| Orthodox | 94 | 45 | 107 | 54 | 88 | 41 | 77 | 33 |
| Other Christians | 83 | 37 | 89 | 41 | 78 | 34 | 66 | 26 |
| Muslim | 113 | 58 | 114 | 60 | 117 | 61 | 82 | 37 |
| **Ethnic Group** | | | | | | | | |
| Amhara | 89 | 42 | 106 | 53 | 80 | 35 | 68 | 27 |
| Guraghe | 91 | 43 | 105 | 53 | 89 | 41 | 82 | 37 |
| Oromo | 99 | 48 | 100 | 49 | 99 | 48 | 93 | 44 |
| Tigreway | 106 | 53 | 128 | 70 | 96 | 47 | 70 | 29 |
| Others | 116 | 60 | 115 | 60 | 119 | 63 | 94 | 45 |
| **Migration Status** | | | | | | | | |
| Recent Migrants (< 5 years) | 108 | 55 | 115 | 60 | 103 | 52 | 88 | 41 |
| Long time migrants | 94 | 45 | 106 | 54 | 92 | 44 | 76 | 33 |
| Non-migrants | 93 | 44 | 103 | 51 | 87 | 40 | 73 | 31 |
| **Educational Attainment** | | | | | | | | |
| Illiterate | 124 | 67 | 127 | 69 | 123 | 67 | 110 | 56 |
| Primary | 90 | 42 | 94 | 45 | 91 | 43 | 80 | 36 |
| Junior secondary | 72 | 30 | 75 | 32 | 76 | 33 | 67 | 27 |
| Secondary and above | 48 | 16 | 52 | 18 | 49 | 16 | 41 | 12 |
| **Marital status** | | | | | | | | |
| Never married | 98 | 48 | 120 | 64 | 112 | 58 | 83 | 37 |
| Currently married | 84 | 38 | 94 | 45 | 81 | 36 | 64 | 25 |
| Divorced | 121 | 64 | 137 | 77 | 109 | 56 | 91 | 43 |
| Widowed | 109 | 56 | 129 | 70 | 101 | 50 | 85 | 39 |
| **Occupation** | | | | | | | | |
| High status occupation | 48 | 16 | 53 | 19 | 50 | 17 | 40 | 12 |
| Service workers | 117 | 61 | 124 | 67 | 107 | 54 | 93 | 44 |
| Agricultural workers | 121 | 64 | 129 | 71 | 121 | 64 | 98 | 48 |
| Unemployed or non active | 93 | 45 | 101 | 50 | 93 | 44 | 77 | 33 |
| **Material of floor** | | | | | | | | |
| Mud | 106 | 53 | 111 | 57 | 103 | 51 | 90 | 42 |
| Tiles or cement | 70 | 29 | 82 | 36 | 72 | 30 | 58 | 22 |
| Others | 73 | 30 | 76 | 33 | 64 | 26 | 81 | 37 |
| **Type of water supply** | | | | | | | | |
| Tap inside or compound | 70 | 29 | 90 | 42 | 68 | 28 | 61 | 24 |
| Tap outside of compound | 103 | 52 | 108 | 55 | 105 | 53 | 90 | 42 |
| Well or river | 109 | 56 | 112 | 57 | 102 | 50 | 87 | 40 |
| **Type of kitchen** | | | | | | | | |
| Modern | 71 | 30 | 77 | 33 | 77 | 33 | 51 | 18 |
| Traditional private | 85 | 39 | 91 | 43 | 82 | 37 | 67 | 27 |
| Traditional shared | 88 | 41 | 97 | 47 | 90 | 42 | 83 | 37 |
| No Kitchen | 118 | 62 | 127 | 69 | 115 | 60 | 86 | 39 |
| **Type of bathing facilities** | | | | | | | | |
| Bath or shower | 66 | 26 | 73 | 31 | 58 | 22 | 45 | 15 |
| No bath or shower | 100 | 49 | 109 | 56 | 96 | 46 | 79 | 35 |

| Socio-demographic, socio-economic and housing characteristics | Total urban areas | | Urban areas with less than 20,000 inhabitants | | Urban areas with 20,000 inhabitants or more | | Addis Ababa | |
|---|---|---|---|---|---|---|---|---|
| | $_0q_1$ per 1,000 | $_1q_4$ per 1,000 | $_0q_1$ per 1,000 | $_1q_4$ per 1,000 | $_0q_1$ per 1,000 | $_1q_4$ per 1,000 | $_0q_1$ per 1,000 | $_1q_4$ per 1,000 |
| **Type of toilet** | | | | | | | | |
| Private toilet | 78 | 34 | 86 | 40 | 79 | 34 | 53 | 19 |
| Shared toilet | 84 | 38 | 90 | 43 | 89 | 41 | 76 | 30 |
| No toilet | 119 | 62 | 125 | 67 | 113 | 59 | 98 | 48 |
| **Density of occupation** | | | | | | | | |
| Not over crowded | 101 | 50 | 117 | 61 | 97 | 47 | 74 | 32 |
| Over crowded | 96 | 46 | 106 | 53 | 91 | 43 | 74 | 32 |
| Highly overcrowded | 98 | 48 | 105 | 53 | 97 | 47 | 82 | 37 |
| **Economic Status** | | | | | | | | |
| High | 65 | 26 | 89 | 41 | 72 | 30 | 53 | 19 |
| Medium | 81 | 36 | 86 | 40 | 81 | 36 | 72 | 30 |
| Low | 117 | 62 | 123 | 66 | 111 | 57 | 98 | 48 |
| **Total** | **98** | **48** | **108** | **55** | **95** | **46** | **76** | **33** |

Source: Authors' calculations on 1994 Census data, made available by CSA

Notes: The rates are calculated using Coale-Demeny West Model (Trusell equations) and refer to average rates corresponding to the age groups 20-24, 25-29 and 30-34. This implicates that they refer to the years 1990-92.

Regarding the density of occupation of the housing unit measured as persons per room, the observed results are not consistent. These results contradict the expectation that overcrowded houses pose a higher risk for infants and children in terms of transmitting diseases.

Regarding the relationship between economic status of the household and infant mortality, in the absence of direct indicators of the households' economic status, for the present study an indicator has been specifically calculated, based on the availability of TV and radio in the household. The results obtained conform to the general expectation. Infant mortality declines sharply as the economic status of the household increases. Thus, women who enjoy relatively high economic status have an infant mortality rate, which is – for all urban areas and for the capital city - about half of that of women who live in households with a low economic status.

Table 6.2 Infant and child mortality rates by housing and women characteristics, Addis Ababa 1994

| Socio-demographic, socio-economic and housing characteristics | Infant mortality rate ($_0q_1$ per 1,000) | | | Child mortality rate ($_1q_4$ per 1,000) | | |
|---|---|---|---|---|---|---|
| | Total | Male | Female | Total | Male | Female |
| **Religion** | | | | | | |
| Orthodox | 77 | 87 | 68 | 33 | 40 | 27 |
| Other Christians | 66 | 70 | 61 | 26 | 29 | 24 |
| Muslim | 82 | 92 | 71 | 37 | 44 | 29 |
| **Ethnic Group** | | | | | | |
| Amhara | 68 | 78 | 59 | 27 | 34 | 22 |
| Guraghe | 82 | 90 | 73 | 37 | 43 | 31 |

| Socio-demographic, socio-economic and housing characteristics | Infant mortality rate ($_0q_1$ per 1,000) | | | Child mortality rate ($_1q_4$ per 1,000) | | |
|---|---|---|---|---|---|---|
| | **Total** | **Male** | **Female** | **Total** | **Male** | **Female** |
| Oromo | 93 | 103 | 82 | 44 | 51 | 37 |
| Tigreway | 70 | 76 | 63 | 29 | 33 | 25 |
| Others | 94 | 109 | 82 | 45 | 55 | 37 |
| **Migration Status** | | | | | | |
| Recent Migrants (< 5 years) | 88 | 94 | 74 | 41 | 45 | 32 |
| Long time migrants | 76 | 84 | 68 | 33 | 38 | 28 |
| Non-migrants | 73 | 81 | 61 | 31 | 36 | 23 |
| **Educational Attainment** | | | | | | |
| Illiterate | 110 | 122 | 98 | 56 | 65 | 48 |
| Primary | 80 | 90 | 70 | 36 | 42 | 29 |
| Junior secondary | 67 | 76 | 58 | 27 | 33 | 22 |
| Secondary and above | 41 | 52 | 37 | 12 | 18 | 10 |
| **Marital status** | | | | | | |
| Never married | 83 | 87 | 76 | 37 | 40 | 33 |
| Currently married | 64 | 72 | 55 | 25 | 30 | 20 |
| Divorced | 91 | 101 | 81 | 43 | 50 | 36 |
| Widowed | 85 | 82 | 87 | 39 | 37 | 40 |
| **Occupation** | | | | | | |
| High status occupation | 40 | 46 | 34 | 12 | 15 | 9 |
| Service workers | 93 | 110 | 75 | 44 | 56 | 32 |
| Agricultural workers | 98 | 111 | 84 | 48 | 57 | 38 |
| Unemployed or non active | 77 | 84 | 69 | 33 | 38 | 28 |
| **Material of floor** | | | | | | |
| Mud | 90 | 101 | 79 | 42 | 50 | 35 |
| Tiles or cement | 58 | 66 | 50 | 22 | 26 | 17 |
| Others | 81 | 86 | 74 | 37 | 40 | 32 |
| **Source of water** | | | | | | |
| Tap inside or compound | 61 | 67 | 55 | 24 | 27 | 20 |
| Tap outside of compound | 90 | 106 | 78 | 42 | 54 | 34 |
| Well or river | 87 | 103 | 68 | 40 | 52 | 29 |
| **Type of kitchen** | | | | | | |
| Modern | 51 | 53 | 61 | 18 | 19 | 24 |
| Traditional private | 67 | 73 | 59 | 27 | 31 | 22 |
| Traditional shared | 83 | 95 | 70 | 37 | 46 | 29 |
| No Kitchen | 86 | 96 | 75 | 39 | 47 | 32 |
| **Type of bathing facilities** | | | | | | |
| Bath or shower | 45 | 48 | 42 | 15 | 16 | 13 |
| No bath or shower | 79 | 89 | 69 | 35 | 42 | 28 |
| **Type of toilet** | | | | | | |
| Private toilet | 53 | 59 | 45 | 19 | 22 | 15 |
| Shared toilet | 76 | 86 | 67 | 30 | 39 | 27 |
| No toilet | 98 | 109 | 87 | 48 | 56 | 40 |
| **Density of occupation** | | | | | | |
| Not over crowded | 74 | 86 | 62 | 32 | 40 | 24 |
| Over crowded | 74 | 83 | 65 | 32 | 37 | 26 |
| Highly overcrowded | 82 | 91 | 73 | 37 | 43 | 31 |
| **Economic Status** | | | | | | |
| High | 53 | 57 | 51 | 19 | 21 | 17 |
| Medium | 72 | 80 | 62 | 30 | 35 | 24 |
| Low | 98 | 110 | 86 | 48 | 56 | 39 |
| **Total** | **76** | **87** | **67** | **33** | **40** | **27** |

Source: Authors' calculations on 1994 Census data, made available by CSA

Notes: The rates are calculated using Coale-Demeny West Model (Trusell equations) and refer to average rates corresponding to the age groups 20-24, 25-29 and 30-34. This implicates that they refer to the years 1990-92.

## 6.2 Characterisation of homogeneous groups of women and estimates of infant and child mortality

In this section of the report the authors attempt at first to identify groups of women with specific socio-demographic and socio-economic characteristics and household conditions. In a second step infant and child mortality rates are estimated for these socially and economically relative homogenous groups. This analysis aims at uncovering relatively homogeneous groups according to specific socio-demographic and socio-economic information. The rationale behind this approach is the hypothesis that the socio-demographic and socio-economic situation of the women – or the respective households – are strongly interrelated. Their combination affects the level of infant and child mortality.

The classification of women is based on a multiple correspondence analysis of the female population in age of childbearing based on selected individual and housing characteristics and according to the size of the urban areas. The multiple correspondence analysis could be described as a principal component analysis based not on the usual Euclidean metric but based on the $\times^2$ metric. It is far more flexible and more data oriented, so the best way to summarise the available qualitative information. The variables which were taken into consideration in the multiple correspondence analysis are: religion, ethnic group, migration status and educational attainment at the individual level, construction material of the floor, source of drinking water, the condition of crowding and economic status at the household level, and the urban category of residence (urban areas with less than 20,000 inhabitants, urban areas with 20,000 and more inhabitants and the capital city Addis Ababa). Some individuals were excluded at this step because the modality 'others' in the case of religion was not considered due to very small numbers. The advantage of the multiple correspondence analysis is its ability to summarise qualitative information without any precondition regarding the distribution of values etc. The multiple correspondence analysis[4] summarises the various socio-demographic characteristics in factors. The first five factors were retained by the authors as the most significant. These first 5 factors 'explain' 38.3% of the total variation taking all included information into account, which is quite satisfactory in view of the analysis of qualitative data. The values of the first five factors were estimated for each individual. Based on these five selected factor values, ten homogenous groups[5] were formed. The number of groups which are

[4] The software package used for the multiple correspondence analysis is SPAD 3.0. The assistance of G. Caruso is gratefully acknowledged.

[5] Using the SPSS statistical software package, a two step solution was implemented. At first a k-mean cluster procedure led to the formation of 25 clusters, which were then grouped with a hierarchical cluster procedure into 10 clusters.

retained are a subjective decision and results could vary slightly according to which variables are considered significant, the number of factors retained and the methods of cluster analysis applied to the factor values. Estimates of infant and child mortality rates for these ten groups, which are relative homogeneous and differ in comparison to each other, open a wide array of values. Infant and child mortality rates for the different groups are reported in Table 6.3. More detailed results of the analysis are shown in Table A4 in the Annex.

The two groups characterised by the highest infant mortality rates, which are in the context of this report the most vulnerable groups, have infant mortality rates of 120 infant deaths per 1,000 live births. Together these two groups comprise about 17 % of the female population. Both cases are dominated by a population of Muslim believe. Most women of the first group are living in small urban areas and this group is characterised by the worst condition regarding the water supply: only 4.4 % of women are living in households with tap inside the house or on the compound. The second group has the highest percentage of recent migrants. The following two groups have still high infant mortality rates at a level of about 110 infant death per 1,000 live births. Both groups are predominantly Orthodox. The third group belongs to a large extent to the Tigreway ethnic group and the percentage of recent migrants is high. The fifth group with average infant and child mortality rates is characterised by a higher than average percentage of Muslim and the majority is part of the Guragie ethnic group. About 60 % of this group live in Addis Ababa. Together with the first two groups this group has the highest average number of children at the age 30-34. This group is succeeded by two intermediate groups with infant mortality rates of 86 and 81 deaths per 1,000 live births. Most women of the three following groups with the lowest infant and child mortality rates live in the capital city or at least in large urban areas. All these three groups are characterised by more complex household structures as can be deducted from the high presence of the category ‘others’ in the variable household structure and a relative high percentage of unmarried women. The women of the eighth group (3.4 % of the population) belong predominantly to the Guragie ethnic group, whereas the dominant characteristic of the ninth group (20.6 % of the population) is the Orthodox religion. The last group, which comprises only 2.1 % of the population, has the absolute lowest infant mortality rates with 37 death per 1,000 live births. The majority of women of this group are Protestant or Catholic and they have the highest average number of years of schooling, close to 10 years. About half of them live in the capital city.

The single most important characteristic, which distinguishes between the groups, ordered according their estimated infant and child mortality rates is educational attainment or the mean number of years of schooling received. The women of the first three groups with an average of 2.3, 1.0 and 2.2 years of schooling, respectively, are to be considered illiterate. It has to be noted, that only the mortality indices estimated for the first group of women is in discordance with their level of education. The household variables included in the multiple correspondence analysis or reported in addition in table A4 contribute to the explanation of the differences in infant mortality between the groups. The first three groups with the highest infant mortality rates have a high proportion of mud floors and are characterised through the absence of tap water, kitchen and toilet. The groups with

moderate mortality indices take an intermediate position regarding the housing conditions. Women in the three groups with low infant mortality enjoy more favourable housing conditions. It seems that cultural and geographic influences, as expressed by religion and ethnic group, can have an effect on the infant and child mortality. Education and the well-being, in an economic and sanitary perspective, of the household are the key variables found in this analysis.

Table 6.3 Infant and child mortality rates for groups of women, Urban Ethiopia 1994

| **Groups of women, defined by dominant characteristics** | **Infant mortality rate ($_0q_1$ per 1,000)** | | | **Child mortality rate ($_1q_4$ per 1,000)** | | |
|---|---|---|---|---|---|---|
| | **Total** | **Male** | **Female** | **Total** | **Male** | **Female** |
| 1. Poor and illiterate small towns 11.1% | 122 | 128 | 116 | 66 | 70 | 61 |
| 2. Poor and illiterate Muslim 5.9% | 120 | 130 | 109 | 64 | 72 | 56 |
| 3. Poor and illiterate Orthodox Tigreway 3.7% | 112 | 122 | 102 | 58 | 65 | 51 |
| 4. Orthodox small towns 15.1% | 109 | 121 | 97 | 56 | 65 | 47 |
| 5. Orthodox and Muslim Guragie 4.7% | 96 | 104 | 88 | 46 | 52 | 40 |
| 6. Middle class Orthodox Amhara 28.3% | 86 | 94 | 75 | 40 | 45 | 33 |
| 7. Orthodox/other Christian, small towns 5.0% | 81 | 87 | 74 | 36 | 40 | 31 |
| 8. Well-off and educated AA Guragie 3.4% | 57 | 64 | 48 | 21 | 26 | 16 |
| 9. Well-off and educated AA Orthodox 20.6% | 56 | 60 | 52 | 21 | 23 | 18 |
| 10. Well-off and educated other Christians 2.1% | 34 | 39 | 29 | 9 | 11 | 7 |
| **Total** | **95** | **107** | **82** | **46** | **54** | **37** |

Source: Authors' calculations on 1994 Census data, made available by CSA

Notes: The rates are calculated using Coale-Demeny West Model (Trusell equations) and refer to average rates corresponding to the age groups 20-24, 25-29 and 30-34. This implicates that they refer to the years 1990-92.

# CHAPTER 7
# SUMMARY AND RECOMMENDATIONS

This report presents an analysis of infant and child mortality based on the 1994 Population and Housing Census of Ethiopia. An analysis at the zone level and at the individual level considering socio-economic and housing information was conducted.

Infant mortality rates show considerable variations between zones. According to the analysis of aggregate data, the education of mothers, the average household size, the availability of a protected source of water and the improved sanitary conditions of households lead to lower levels of infant mortality rates. Temperature, persons per room and the level of fertility, measured by the total fertility rate (TFR), are positively correlated with infant mortality rate. A multivariate analysis of infant mortality rates in urban areas by zone show that the educational level of women and average temperature 'determine' the regional pattern of infant mortality rates.

Descriptive and multivariate analyses were also used in analysing individual data. This analysis was conducted for Addis Ababa, major urban centres and small towns, separately. The study of the impact of single variables shows that education of women has the most significant impact on infant mortality rates. The rates vary in urban areas of Ethiopia from 124 infant deaths per 1,000 live births for the illiterate to 48 for the educational level 'secondary and above'. Other socio-economic variables that have a more modest impact on infant mortality rates are the migration status of women, the marital status of women, and the occupation of women. Ethnic origin gives no consistent indication regarding its relation with infant mortality. Religious affiliations did produce important differences in infant mortality rates at the country level but the difference appears to diminish for Addis Ababa. Also the impact of housing characteristics on infant mortality was confirmed in the analysis.

Multiple correspondence analysis was applied to define 'homogeneous' groups of women. For these groups infant and child mortality rates were estimated. The results show that the educational level and the well-being – in an economic and sanitary sense – of the household are the most important variables. Children of poor and illiterate women are the most disadvantaged groups in terms of infant and child mortality. This observation is more pronounced for women living in small towns.

In summary, the single most important variable to 'explain' the level of infant and child mortality seems to be education of women and education in general. Other socio-demographic and socio-economic characteristics, as well as housing conditions, are often directly related to the educational level of the household head or the educational level of mothers. To assure the success of a technical policy approach, the educational level of the Ethiopian population in general and women in particular have to be improved. Thus, the improvement in education and providing –at least– elementary level education would have a marked role in reducing infant and child mortality. The lack of education especially in rural areas and smaller urban areas is an important obstacle in lowering further infant and child mortality.

The study revealed that better housing conditions improve the chance of surviving of new-borns and infants. Any policy has to tackle the medical aspects of infant and child mortality. The creation, maintenance and improvement of public infrastructure –water supply and wastewater management– and of private housing conditions is another precondition of further improvements in child survival. From the statistical side the most important goal must be to improve the measurement of infant mortality through direct measures and refined indirect methods. The authors hope that the results of the recently conducted Ethiopian Demographic and Health Survey and the planned 2004 census will be thoroughly analysed to confirm – or refute – the results of the present report.

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# ANNEXES

Figure A1 Names of Zones, Ethiopia 1994


Note: Boundaries are approximate and unofficial

Source: http://www.wfp.it/

Table A1 Infant and child mortality rates, Ethiopia 1950-2050

| Year | Infant mortality rate (per 1,000) | Child mortality rate (per 1,000) |
|---|---|---|
| 1950-1955 | 208 | n.a. |
| 1955-1960 | 193 | n.a. |
| 1960-1965 | 180 | n.a. |
| 1965-1970 | 167 | n.a. |
| 1970-1975 | 154 | n.a. |
| 1975-1980 | 149 | n.a. |
| 1980-1985 | 148 | n.a. |
| 1985-1990 | 133 | n.a. |
| 1990-1995 | 123 | 194 |
| 1995-2000 | 116 | 184 |
| 2000-2005 | 103 | 165 |
| 2005-2010 | 91 | 142 |
| 2010-2015 | 79 | 122 |
| 2015-2020 | 70 | 105 |
| 2020-2025 | 60 | 89 |
| 2025-2030 | 52 | 75 |
| 2030-2035 | 44 | 63 |
| 2035-2040 | 39 | 55 |
| 2040-2045 | 34 | 49 |
| 2045-2050 | 30 | 44 |

Source: United Nations (199

Table A2 Regional variations in infant and child mortality, Ethiopia 1994

| Zone | Infant and child mortality rates (per 1.000) by settlement size | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rural areas | | | | | | Urban areas | | | | | | Total | | | | | |
| | Infant mortality | | | Mortality under 5 | | | Infant mortality | | | Mortality under 5 | | | Infant mortality | | | Mortality under 5 | | |
| | total | m | f | total | m | f | total | m | f | total | m | f | total | m | f | total | m | f |
| 101 Western Tigray | 117 | 127 | 106 | 171 | 181 | 161 | 147 | 157 | 136 | 219 | 228 | 210 | 120 | 130 | 110 | 177 | 186 | 167 |
| 102 Central Tigray | 124 | 135 | 112 | 182 | 195 | 170 | 112 | 129 | 96 | 164 | 184 | 143 | 123 | 135 | 110 | 181 | 194 | 167 |
| 103 Eastern Tigray | 112 | 120 | 103 | 163 | 171 | 155 | 114 | 129 | 99 | 166 | 184 | 148 | 112 | 122 | 102 | 163 | 173 | 153 |
| 104 Southern Tigray | 136 | 149 | 122 | 202 | 216 | 188 | 116 | 127 | 105 | 170 | 181 | 158 | 132 | 145 | 119 | 196 | 209 | 183 |
| 200 Affar | | | | | | | | | | | | | 118 | 107 | 133 | 174 | 150 | 206 |
| 301 Northern Gondar | 108 | 113 | 97 | 151 | 159 | 144 | 107 | 124 | 91 | 156 | 176 | 135 | 105 | 114 | 97 | 153 | 161 | 144 |
| 302 Southern Gondar | 116 | 123 | 107 | 169 | 175 | 162 | 93 | 106 | 80 | 132 | 148 | 117 | 114 | 122 | 106 | 167 | 174 | 159 |
| 303 Northern Wello | 113 | 123 | 103 | 165 | 175 | 154 | 110 | 121 | 98 | 159 | 171 | 146 | 113 | 123 | 102 | 165 | 174 | 154 |
| 304 Southern Wello | 131 | 145 | 117 | 195 | 209 | 180 | 93 | 106 | 79 | 133 | 149 | 116 | 128 | 141 | 114 | 189 | 203 | 174 |
| 305 Northern Shewa (Amhara) | 101 | 112 | 90 | 145 | 157 | 133 | 96 | 103 | 89 | 138 | 143 | 131 | 101 | 111 | 90 | 145 | 156 | 133 |
| 306 Eastern Gojam | 143 | 155 | 131 | 213 | 224 | 203 | 112 | 123 | 101 | 163 | 175 | 151 | 142 | 153 | 130 | 211 | 222 | 200 |
| 307 Western Gojam | 111 | 120 | 101 | 161 | 170 | 152 | 110 | 121 | 99 | 160 | 172 | 148 | 111 | 120 | 101 | 161 | 170 | 152 |
| 308 Wag Hemra | 115 | 122 | 107 | 168 | 173 | 162 | 110 | 116 | 103 | 160 | 164 | 156 | 114 | 122 | 107 | 167 | 173 | 162 |
| 309 Agew Awi | 107 | 115 | 99 | 155 | 162 | 147 | 96 | 108 | 83 | 137 | 151 | 121 | 106 | 114 | 97 | 154 | 161 | 145 |
| 310 Oromiya | 132 | 138 | 126 | 197 | 199 | 194 | 124 | 131 | 117 | 182 | 187 | 178 | 132 | 138 | 125 | 195 | 198 | 192 |
| 311 Bahir Dar | | | | | | | 85 | 100 | 70 | 120 | 139 | 99 | 85 | 100 | 70 | 120 | 139 | 99 |
| 401 Western Wellega | 123 | 134 | 112 | 181 | 192 | 170 | 83 | 93 | 74 | 117 | 129 | 106 | 119 | 130 | 108 | 175 | 186 | 163 |
| 402 Eastern Wellega | 112 | 124 | 98 | 162 | 176 | 147 | 82 | 97 | 66 | 115 | 134 | 95 | 108 | 121 | 95 | 157 | 172 | 142 |
| 403 Illubabor | 124 | 139 | 109 | 183 | 199 | 166 | 74 | 79 | 68 | 102 | 108 | 97 | 120 | 134 | 106 | 176 | 191 | 160 |
| 404 Jimma | 150 | 164 | 136 | 225 | 239 | 210 | 103 | 116 | 91 | 148 | 164 | 135 | 147 | 161 | 132 | 219 | 233 | 204 |
| 405 Western Shewa | 112 | 126 | 99 | 163 | 179 | 148 | 93 | 107 | 80 | 133 | 150 | 116 | 111 | 123 | 97 | 161 | 175 | 145 |
| 406 Northern Shewa (Oromiya) | 108 | 120 | 95 | 156 | 170 | 142 | 81 | 99 | 63 | 114 | 138 | 90 | 106 | 118 | 94 | 154 | 168 | 139 |
| 407 Eastern Shewa | 134 | 143 | 123 | 198 | 206 | 190 | 105 | 119 | 91 | 151 | 168 | 134 | 128 | 139 | 117 | 190 | 200 | 179 |
| 408 Arssi | 131 | 141 | 121 | 195 | 203 | 186 | 96 | 107 | 85 | 137 | 150 | 124 | 128 | 138 | 118 | 190 | 198 | 181 |
| 409 Western Harerge | 132 | 136 | 126 | 195 | 195 | 194 | 123 | 126 | 120 | 182 | 180 | 183 | 131 | 135 | 126 | 194 | 194 | 194 |
| 410 Eastern Harerge | 117 | 121 | 113 | 171 | 171 | 172 | 91 | 94 | 87 | 129 | 130 | 129 | 116 | 120 | 111 | 170 | 170 | 169 |
| 411 Bale | 120 | 128 | 110 | 176 | 183 | 167 | 72 | 79 | 65 | 100 | 107 | 92 | 116 | 124 | 106 | 169 | 176 | 161 |
| 412 Borena | 72 | 74 | 69 | 99 | 100 | 99 | 83 | 88 | 77 | 117 | 122 | 111 | 73 | 75 | 70 | 101 | 101 | 100 |
| 500 Somali | | | | | | | | | | | | | 96 | 90 | 102 | 137 | 125 | 153 |

| Zone | Infant and child mortality rates (per 1.000) by settlement size | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rural areas | | | | | | Urban areas | | | | | | Total | | | | | |
| | Infant mortality | | | Mortality under 5 | | | Infant mortality | | | Mortality under 5 | | | Infant mortality | | | Mortality under 5 | | |
| | total | m | f | total | m | f | total | m | f | total | m | f | total | m | f | total | m | f |
| 600 Benishangul-Gumuz | 140 | 147 | 133 | 209 | 213 | 205 | 113 | 121 | 104 | 164 | 172 | 156 | 139 | 145 | 131 | 206 | 210 | 203 |
| 701 Gurage | 147 | 161 | 134 | 221 | 233 | 208 | 109 | 121 | 97 | 159 | 172 | 145 | 145 | 158 | 132 | 218 | 229 | 204 |
| 702 Hadiya | 115 | 125 | 106 | 169 | 177 | 161 | 78 | 85 | 70 | 108 | 117 | 100 | 113 | 122 | 104 | 165 | 173 | 156 |
| 703 Kembata Alabana Tembaro | 132 | 142 | 122 | 196 | 203 | 187 | 97 | 115 | 81 | 140 | 162 | 119 | 130 | 140 | 119 | 192 | 201 | 183 |
| 704 Sidama | 88 | 93 | 83 | 125 | 127 | 122 | 80 | 82 | 78 | 113 | 112 | 113 | 88 | 92 | 83 | 124 | 126 | 122 |
| 705 Gedeo | 129 | 137 | 202 | 191 | 196 | 309 | 101 | 109 | 92 | 145 | 153 | 136 | 127 | 134 | 119 | 187 | 193 | 181 |
| 706 Northern Omo | 157 | 168 | 145 | 234 | 245 | 224 | 118 | 126 | 109 | 173 | 179 | 166 | 154 | 165 | 142 | 231 | 241 | 220 |
| 707 Southern Omo | 118 | 120 | 115 | 172 | 169 | 176 | 121 | 131 | 109 | 170 | 187 | 165 | 118 | 120 | 115 | 173 | 170 | 176 |
| 709 Keficho Shekicho | 158 | 172 | 143 | 236 | 251 | 221 | 101 | 114 | 88 | 146 | 162 | 130 | 153 | 168 | 139 | 229 | 244 | 214 |
| 711 Bench Maji | 195 | 210 | 180 | 292 | 305 | 278 | 95 | 98 | 91 | 136 | 136 | 135 | 190 | 204 | 175 | 285 | 297 | 271 |
| 712 Yem Special Wereda | 130 | 153 | 106 | 193 | 223 | 160 | | | | | | | 129 | 152 | 104 | 190 | 219 | 156 |
| 713 Amaro Special Wereda | 74 | 78 | 70 | 103 | 106 | 100 | | | | | | | 74 | 77 | 69 | 102 | 105 | 98 |
| 714 Burji Special Wereda | 104 | 111 | 97 | 151 | 156 | 145 | | | | | | | 99 | 107 | 91 | 142 | 150 | 135 |
| 715 Konso Special Wereda | 111 | 114 | 107 | 161 | 161 | 161 | | | | | | | 111 | 115 | 106 | 161 | 163 | 160 |
| 716 Dirashe Special Wereda | 125 | 132 | 116 | 184 | 190 | 177 | | | | | | | 119 | 126 | 112 | 175 | 179 | 170 |
| 1200 Gambella | 96 | 98 | 93 | 137 | 137 | 139 | 113 | 127 | 102 | 164 | 181 | 146 | 99 | 103 | 94 | 142 | 144 | 140 |
| 1300 Harari | 128 | 128 | 129 | 190 | 182 | 199 | 84 | 87 | 80 | 118 | 119 | 117 | 113 | 114 | 112 | 166 | 161 | 172 |
| 1400 Addis Ababa | 112 | 113 | 110 | 162 | 163 | 160 | 77 | 87 | 67 | 107 | 121 | 93 | 78 | 87 | 69 | 109 | 122 | 95 |
| 1500 Dire Dawa | 103 | 101 | 105 | 150 | 141 | 159 | 122 | 135 | 108 | 178 | 194 | 162 | 115 | 122 | 107 | 168 | 173 | 162 |
| **Ethiopia** | **121** | **130** | **112** | **178** | **186** | **170** | **98** | **109** | **87** | **140** | **153** | **128** | **116** | **125** | **108** | **171** | **178** | **164** |

Source: Central Statistical Authority (1995-99), Population and Housing Census of Ethiopia 1994, Statistical Reports

Notes: The rates are calculated using Coale-Demeny West Model (Trusell equations) and refer to average rates corresponding to the age groups 20-24, 25-29 and 30-34. This implicates that they refer to the years 1990-92.

Table A3 Distribution of Women (20 to 34 years old) by socio-demographic and household characteristics, Ethiopia 1994

| Socio-demographic, socio-economic and housing characteristics | Total urban areas | Urban areas with less than 20,000 inhabitants | Urban areas with 20,000 inhabitants or more | Addis Ababa |
|---|---|---|---|---|
| | % | % | % | % |
| **Religion** | | | | |
| Orthodox | 72.5 | 64.9 | 70.2 | 83.5 |
| Other Christians | 7.2 | 7.9 | 7.6 | 6.0 |
| Muslim | 19.7 | 26.3 | 21.8 | 9.9 |
| **Ethnic Group** | | | | |
| Amhara | 47.9 | 42.9 | 47.3 | 54.3 |
| Guraghe | 8.0 | 4.4 | 6.2 | 14.0 |
| Oromo | 20.7 | 25.3 | 17.5 | 18.1 |
| Tigreway | 9.2 | 8.3 | 12.0 | 7.9 |
| Others | 14.1 | 19.2 | 16.9 | 5.7 |
| **Migration Status** | | | | |
| Recent Migrants (< 5 years) | 29.2 | 37.9 | 32.5 | 15.9 |
| Long time migrants | 33.5 | 27.5 | 33.4 | 40.7 |
| Non-migrants | 37.2 | 34.5 | 33.9 | 43.2 |
| **Educational Attainment** | | | | |
| Illiterate | 34.9 | 51.1 | 32.3 | 17.8 |
| Primary | 21.1 | 21.0 | 20.8 | 21.4 |
| Junior secondary | 11.2 | 9.4 | 12.2 | 12.4 |
| Secondary and above | 32.7 | 18.3 | 34.4 | 48.3 |
| **Marital status** | | | | |
| Never married | 34.1 | 20.5 | 32.6 | 51.9 |
| Currently married | 48.6 | 58.1 | 50.2 | 35.9 |
| Divorced | 13.8 | 17.8 | 13.2 | 9.5 |
| Widowed | 2.5 | 2.7 | 2.8 | 2.2 |
| **Occupation** | | | | |
| High status occupation | 8.3 | 5.6 | 8.9 | 11.1 |
| Service workers | 18.7 | 25.8 | 17.7 | 10.9 |
| Agricultural workers | 11.1 | 11.2 | 8.8 | 13.2 |
| Unemployed or non active | 61.9 | 57.4 | 64.6 | 64.8 |
| **Material of floor** | | | | |
| Mud | 63.6 | 83.2 | 60.5 | 42.8 |
| Tiles or cement | 32.3 | 12.4 | 33.9 | 54.6 |
| Others | 2.1 | 1.9 | 2.9 | 1.6 |
| **Type of water supply** | | | | |
| Tap inside or compound | 34.4 | 11.7 | 35.6 | 60.4 |
| Tap outside of compound | 41.9 | 44.3 | 44.5 | 37.0 |
| Well or river | 22.1 | 42.4 | 17.9 | 1.7 |
| **Type of kitchen** | | | | |
| Modern | 6.3 | 4.0 | 6.7 | 8.7 |
| Traditional private | 41.7 | 41.7 | 44.2 | 39.7 |
| Traditional shared | 20.1 | 10.3 | 20.4 | 31.5 |
| No Kitchen | 30.3 | 42.3 | 26.6 | 19.2 |
| **Type of bathing facilities** | | | | |
| Bath or shower | 7.5 | 2.7 | 7.4 | 13.2 |
| No bath or shower | 89.7 | 94.2 | 88.9 | 85.2 |

| Socio-demographic, socio-economic and housing characteristics | Total urban areas | Urban areas with less than 20,000 inhabitants | Urban areas with 20,000 inhabitants or more | Addis Ababa |
|---|---|---|---|---|
| | % | % | % | % |
| **Type of toilet** | | | | |
| Private toilet | 34.5 | 31.8 | 36.8 | 35.7 |
| Shared toilet | 29.0 | 15.6 | 30.2 | 44.0 |
| No toilet | 34.4 | 50.6 | 30.3 | 18.6 |
| **Density of occupation** | | | | |
| Not over crowded | 29.3 | 27.2 | 25.8 | 34.8 |
| Over crowded | 42.9 | 43.2 | 42.4 | 43.0 |
| Highly overcrowded | 26.7 | 28.5 | 30.2 | 21.5 |
| **Economic Status** | | | | |
| High | 11.4 | 2.1 | 10.0 | 23.7 |
| Medium | 48.2 | 41.6 | 50.0 | 54.5 |
| Low | 38.9 | 54.7 | 38.0 | 20.8 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Authors' calculations on 1994 Census data, made available by CSA

Table A4 Characteristics of groups and infant and child mortality rates, urban Ethiopia 1994

| Socio-demographic, socio-economic and housing characteristics | Total urban | Less than 20,000 inhabitants | More than 20,000 inhabitants | Addis Ababa | Highest infant mortality | | | High infant mortality | | | | Low infant mortality | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| **N** | 1,500,439 | 567,543 | 434,468 | 498,428 | 167,273 | 88,482 | 55,667 | 226,614 | 70,501 | 424,418 | 75,196 | 50,413 | 309,798 | 32,078 |
| **N (not weighted)** | 286,863 | 105,246 | 81,295 | 100,322 | 32,077 | 7,086 | 11,146 | 44,660 | 14,094 | 84,784 | 14,911 | 10,108 | 61,584 | 6,413 |
| **Less than 20,000 inhabitants** | 37.8 | 100.0 | 0.0 | 0.0 | 74.0 | 51.2 | 31.1 | 82.6 | 16.5 | 26.0 | 68.3 | 3.8 | 4.6 | 14.3 |
| **More than 20,000 inhabitants** | 29.0 | 0.0 | 100.0 | 0.0 | 23.0 | 45.2 | 63.0 | 15.7 | 25.6 | 35.7 | 19.2 | 17.4 | 26.6 | 32.4 |
| **Addis Ababa** | 33.2 | 0.0 | 0.0 | 100.0 | 3.0 | 3.6 | 5.9 | 1.7 | 58.0 | 38.3 | 12.6 | 78.8 | 68.8 | 53.3 |
| **Fertility** | | | | | | | | | | | | | | |
| Average number of children ever born at age 30-34 | 3.6 | 4.1 | 3.6 | 2.8 | 4.3 | 4.9 | 3.6 | 3.5 | 4.5 | 3.5 | 3.9 | 3.6 | 2.2 | 2.4 |
| **Infant mortality rate (20-34. Coale-Demeny West model (Trussel equations)** | | | | | | | | | | | | | | |
| Total | 95 | 108 | 98 | 78 | 122 | 120 | 112 | 109 | 96 | 86 | 81 | 57 | 56 | 34 |
| Male | 107 | 116 | 104 | 87 | 128 | 130 | 122 | 121 | 104 | 94 | 87 | 64 | 60 | 39 |
| Female | 82 | 100 | 84 | 68 | 116 | 109 | 102 | 97 | 88 | 75 | 74 | 48 | 52 | 29 |
| Male/female difference (female IMR = 100) | 130 | 116 | 124 | 128 | 110 | 119 | 120 | 125 | 118 | 125 | 118 | 133 | 115 | 134 |
| **Child mortality rate (20-34. Coale-Demeny West model (Trussel equations)** | | | | | | | | | | | | | | |
| Total | 46 | 56 | 48 | 34 | 66 | 64 | 58 | 56 | 46 | 40 | 36 | 21 | 21 | 09 |
| Male | 54 | 61 | 52 | 40 | 70 | 72 | 65 | 65 | 52 | 45 | 40 | 26 | 23 | 11 |
| Female | 37 | 49 | 38 | 27 | 61 | 56 | 51 | 47 | 40 | 33 | 31 | 16 | 18 | 07 |
| Male/female difference (female Imr = 100) | 146 | 124 | 137 | 148 | 115 | 129 | 127 | 138 | 130 | 136 | 129 | 163 | 128 | 157 |
| **Age** | | | | | | | | | | | | | | |
| 15-19 | 36.0 | 34.6 | 37.5 | 36.4 | 31.6 | 33.3 | 28.5 | 33.7 | 38.3 | 38.5 | 39.3 | 43.6 | 36.4 | 35.0 |
| 20-24 | 26.7 | 25.6 | 26.1 | 28.6 | 23.0 | 24.4 | 22.3 | 27.5 | 25.1 | 25.3 | 29.0 | 27.5 | 30.7 | 31.6 |
| 25-29 | 22.1 | 23.1 | 21.5 | 21.5 | 24.8 | 21.7 | 25.8 | 23.2 | 22.2 | 21.3 | 20.9 | 18.2 | 21.1 | 21.4 |
| 30-34 | 15.2 | 16.8 | 14.9 | 13.6 | 20.6 | 20.5 | 23.4 | 15.5 | 14.3 | 14.9 | 10.7 | 10.7 | 11.9 | 12.0 |
| **Relationship to HH** | | | | | | | | | | | | | | |
| Head | 11.4 | 14.5 | 11.8 | 7.6 | 10.7 | 7.1 | 26.5 | 20.0 | 7.8 | 11.9 | 9.6 | 3.5 | 6.4 | 8.2 |
| Spouse | 28.1 | 36.3 | 28.1 | 18.8 | 44.5 | 35.9 | 34.0 | 32.2 | 32.0 | 26.5 | 32.9 | 18.2 | 15.6 | 19.3 |

| Socio-demographic, socio-economic and housing characteristics | Total urban | Less than 20,000 inhabitants | More than 20,000 inhabitants | Addis Ababa | Highest infant mortality | | | High infant mortality | | | | Low infant mortality | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Children | 34.7 | 28.7 | 35.7 | 40.5 | 26.1 | 36.0 | 18.3 | 25.5 | 40.1 | 39.8 | 34.8 | 38.9 | 39.5 | 36.2 |
| Others. relatives and non-relatives | 25.8 | 20.6 | 24.3 | 33.1 | 18.7 | 21.0 | 21.2 | 22.3 | 20.1 | 21.9 | 22.7 | 39.3 | 38.6 | 36.4 |
| **Marital status** | | | | | | | | | | | | | | |
| Never married | 53.1 | 40.4 | 53.5 | 67.3 | 34.1 | 48.2 | 30.3 | 40.2 | 54.6 | 53.8 | 55.1 | 73.4 | 71.3 | 72.8 |
| Married | 34.5 | 43.5 | 34.5 | 24.2 | 52.4 | 42.5 | 45.3 | 39.4 | 38.6 | 33.1 | 38.3 | 21.9 | 20.3 | 23.5 |
| Divorced | 10.0 | 13.5 | 9.2 | 6.6 | 10.7 | 6.3 | 19.9 | 17.8 | 4.8 | 10.4 | 4.8 | 3.1 | 6.8 | 2.4 |
| Widowed | 1.7 | 1.9 | 1.8 | 1.5 | 2.1 | 1.8 | 3.6 | 2.0 | 1.5 | 2.0 | 1.3 | 8.0 | 1.0 | 0.5 |
| **Religion** | | | | | | | | | | | | | | |
| Orthodox | 72.8 | 65.3 | 70.5 | 83.4 | 31.0 | 6.5 | 95.8 | 97.1 | 47.3 | 92.6 | 26.8 | 49.1 | 93.0 | 7.1 |
| Protestant/Catholics | 7.0 | 7.9 | 7.4 | 5.6 | 7.8 | 1.9 | 4.2 | 0.8 | 2.6 | 0.5 | 66.4 | 5.5 | 1.1 | 88.2 |
| Muslim | 19.7 | 26.1 | 21.7 | 10.5 | 60.0 | 90.6 | 0.1 | 1.9 | 49.9 | 6.7 | 4.9 | 44.8 | 5.5 | 2.5 |
| Others | 0.5 | 0.7 | 0.3 | 0.5 | 1.2 | 1.0 | 0.1 | 0.2 | 0.2 | 0.2 | 1.9 | 0.6 | 0.4 | 2.2 |
| **Ethnic group** | | | | | | | | | | | | | | |
| Amhara | 47.5 | 42.7 | 47.1 | 53.3 | 20.7 | 5.0 | 21.9 | 63.3 | 2.3 | 65.5 | 13.4 | 2.8 | 69.3 | 39.5 |
| Guragie | 8.6 | 4.5 | 6.4 | 15.1 | 5.3 | 1.5 | 0.0 | 0.0 | 91.1 | 1.2 | 1.4 | 91.6 | 0.5 | 2.5 |
| Oromo | 20.9 | 25.8 | 17.4 | 18.4 | 39.1 | 6.1 | 0.0 | 23.5 | 5.5 | 20.7 | 54.3 | 4.9 | 14.6 | 29.4 |
| Tigreway | 9.1 | 8.1 | 12.1 | 7.4 | 1.6 | 1.2 | 78.1 | 8.1 | 0.1 | 9.2 | 0.1 | 0.1 | 10.0 | 0.7 |
| Others | 13.9 | 18.8 | 17.0 | 5.7 | 33.3 | 86.2 | 0.0 | 5.2 | 1.0 | 3.4 | 30.8 | 0.7 | 5.6 | 27.8 |
| **Migration status** | | | | | | | | | | | | | | |
| Recent migrants (less than 5 years) | 28.9 | 36.5 | 31.9 | 17.6 | 31.0 | 88.6 | 60.9 | 39.8 | 11.0 | 14.3 | 20.8 | 19.3 | 24.8 | 25.9 |
| Long-time migrants (5 years and more) | 27.7 | 23.3 | 27.4 | 33.0 | 28.5 | 5.9 | 28.1 | 19.7 | 40.5 | 35.8 | 18.4 | 35.1 | 26.0 | 29.7 |
| Non-migrants | 43.4 | 40.3 | 40.7 | 49.4 | 40.4 | 5.4 | 11.0 | 40.5 | 48.5 | 49.9 | 60.8 | 45.6 | 49.2 | 44.4 |
| **Educational attainment** | | | | | | | | | | | | | | |
| Illiterate and | 30.1 | 44.6 | 27.5 | 15.9 | 59.0 | 83.0 | 62.8 | 42.1 | 26.4 | 17.3 | 18.1 | 18.3 | 10.8 | 3.7 |
| Primary (1 to 6 years) | 23.9 | 25.1 | 23.5 | 23.1 | 27.1 | 10.5 | 24.7 | 20.7 | 37.4 | 33.8 | 21.3 | 22.6 | 13.9 | 9.9 |
| Junior Secondary (7 to 8 years) | 16.1 | 13.1 | 17.9 | 18.1 | 9.0 | 2.8 | 5.1 | 12.1 | 20.2 | 24.6 | 25.9 | 16.8 | 13.9 | 13.6 |
| Secondary and above (9 years and more) | 29.8 | 17.2 | 31.2 | 42.9 | 4.9 | 3.7 | 7.5 | 25.0 | 15.9 | 24.3 | 34.8 | 42.4 | 61.3 | 72.8 |
| Average number of years of schooling | 5.5 | 3.9 | 5.8 | 7.2 | 2.3 | 1.0 | 2.2 | 4.5 | 4.8 | 6.0 | 6.6 | 7.0 | 8.6 | 9.9 |
| **Construction material of floor** | | | | | | | | | | | | | | |

| Socio-demographic, socio-economic and housing characteristics | Total urban | Less than 20,000 inhabitants | More than 20,000 inhabitants | Addis Ababa | Highest infant mortality | | | High infant mortality | | | | Low infant mortality | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Cement and tiles | 34.1 | 13.6 | 35.9 | 55.9 | 4.3 | 24.9 | 7.9 | 8.0 | 21.0 | 20.3 | 19.6 | 90.3 | 87.0 | 90.8 |
| Mud | 63.7 | 84.3 | 61.0 | 42.5 | 93.6 | 74.7 | 91.5 | 90.7 | 74.3 | 77.9 | 68.0 | 8.2 | 11.6 | 6.4 |
| Other | 2.2 | 2.1 | 3.1 | 1.6 | 2.1 | 0.4 | 0.7 | 1.4 | 4.7 | 1.8 | 12.3 | 1.5 | 1.4 | 2.8 |
| **Source of drinking water** | | | | | | | | | | | | | | |
| Tap inside or on compound | 36.1 | 12.7 | 37.5 | 61.5 | 4.5 | 21.6 | 13.6 | 10.6 | 17.5 | 24.4 | 18.2 | 88.2 | 90.7 | 86.3 |
| Tap outside | 42.0 | 45.0 | 43.9 | 37.0 | 50.4 | 24.3 | 72.6 | 27.6 | 76.9 | 72.9 | 29.9 | 11.1 | 8.7 | 10.2 |
| Well. river etc. | 21.9 | 42.3 | 18.6 | 1.6 | 45.1 | 54.2 | 13.8 | 61.8 | 5.6 | 2.7 | 51.9 | 0.6 | 0.6 | 3.5 |
| **Type of kitchen** | | | | | | | | | | | | | | |
| Modern | 6.4 | 4.0 | 7.1 | 8.6 | 3.0 | 3.6 | 3.0 | 3.4 | 2.4 | 3.5 | 4.8 | 11.7 | 15.3 | 17.9 |
| Traditional. private | 44.8 | 45.2 | 47.9 | 41.5 | 38.5 | 44.0 | 25.3 | 42.0 | 36.2 | 41.3 | 53.8 | 57.7 | 55.1 | 55.2 |
| Traditional. shared | 19.9 | 10.2 | 19.4 | 31.4 | 10.9 | 13.3 | 29.5 | 12.3 | 31.7 | 27.4 | 13.6 | 20.7 | 19.3 | 16.5 |
| No kitchen | 28.9 | 40.6 | 25.6 | 18.4 | 47.5 | 39.1 | 42.2 | 42.3 | 29.7 | 27.8 | 27.8 | 9.9 | 10.3 | 10.3 |
| **Type of bath** | | | | | | | | | | | | | | |
| Bath or shower | 7.8 | 2.8 | 7.8 | 13.3 | 1.0 | 4.2 | 1.1 | 1.5 | 1.0 | 2.0 | 2.7 | 21.3 | 24.6 | 28.3 |
| Other type of bath | 1.4 | 1.7 | 1.8 | 0.7 | 1.7 | 3.4 | 0.9 | 1.2 | 1.1 | 1.1 | 1.4 | 1.0 | 1.3 | 1.9 |
| No bath | 90.9 | 95.5 | 90.4 | 86.0 | 97.3 | 92.4 | 98.0 | 97.3 | 97.9 | 96.9 | 95.9 | 77.7 | 74.1 | 69.9 |
| **Type of toilet** | | | | | | | | | | | | | | |
| Private toilet | 37.4 | 35.1 | 40.8 | 37.1 | 30.0 | 31.1 | 12.9 | 31.4 | 22.9 | 27.2 | 50.6 | 56.9 | 59.9 | 66.7 |
| Shared toilet | 29.1 | 15.5 | 29.2 | 44.5 | 17.0 | 24.4 | 23.5 | 16.6 | 44.1 | 36.3 | 22.5 | 37.0 | 34.2 | 28.6 |
| No toilet | 33.5 | 49.4 | 30.0 | 18.4 | 52.9 | 44.5 | 63.6 | 51.9 | 33.0 | 36.5 | 26.9 | 6.1 | 5.9 | 4.7 |
| **Crowding** | | | | | | | | | | | | | | |
| Not overcrowded (less than 2 persons per room) | 28.4 | 26.2 | 25.2 | 33.6 | 14.7 | 7.6 | 12.3 | 40.4 | 7.8 | 15.5 | 35.1 | 33.3 | 52.3 | 61.0 |
| Overcrowded (2 to 4 persons per room) | 44.0 | 44.2 | 43.8 | 43.9 | 41.2 | 22.8 | 31.9 | 43.7 | 45.1 | 53.3 | 52.1 | 48.4 | 39.3 | 34.2 |
| Highly overcrowded (4 and more persons per room) | 27.6 | 29.6 | 31.0 | 22.5 | 44.1 | 69.6 | 55.8 | 16.0 | 47.1 | 31.2 | 12.8 | 18.3 | 8.4 | 4.8 |
| **Economic status** | | | | | | | | | | | | | | |
| High (televison set) | 12.1 | 2.3 | 10.7 | 24.5 | 0.5 | 5.6 | 1.1 | 1.1 | 1.2 | 2.2 | 1.4 | 42.8 | 41.7 | 34.2 |
| Middle (radio) | 49.8 | 43.4 | 52.1 | 55.2 | 32.8 | 38.8 | 35.3 | 37.2 | 62.9 | 59.3 | 60.6 | 52.4 | 54.0 | 59.9 |
| Low (no radio and no television set) | 38.1 | 54.3 | 37.2 | 20.2 | 66.7 | 55.5 | 63.7 | 61.6 | 35.9 | 38.6 | 37.9 | 4.8 | 4.3 | 5.9 |